ESSAYS ON THE ECONOMICS OF ELECTRONIC COMMERCE

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ESSAYS ON THE ECONOMICS OF ELECTRONIC COMMERCE

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To My Family and All My Friends

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LIST OF SYMBOLS AND ABBREVIATIONS

IT	Information Technology
RBV	Resource-based View

SUMMARY

This dissertation examines the innovations in electronic commerce and their managerial impacts. In the first essay, we investigate the importance of product and retailer uncertainty in a customer's online purchase decision as well as the uncertainty-reduction effects of retailer characteristics. We find that both types of uncertainty have a negative impact on customer satisfaction. However, customers are more concerned about retailer uncertainty than product uncertainty. A retailer's service quality, website design, and pricing also play important roles in affecting consumer satisfaction. Furthermore, service quality is shown to mitigate the negative impact of retailer uncertainty. Our findings also reveal that higher price signals higher retailer quality; that is, consumers are willing to pay a price premium to get certain quality assurance.

In the second essay, we examine online pricing strategies of B2C retailers, with an aim to understand whether and how the driving factors of price dispersion evolve over time. Our empirical results show that price dispersion has remained substantial over the period of 2001-2006, suggesting that price dispersion is a persistent phenomenon. However, the driving factors of price dispersion have not remained stable; online retailers strategically changed their pricing behaviors over time. In 2001 online book retailers generally engaged in obfuscation when they tried to frustrate consumer search by manipulating shipping options. The prices charged by retailers are positively related with longer shipping times and higher shipping charges, as documented by previous literature. The industry, however, has become more efficient over time. Online retailers are now competing to ship items more quickly than rivals and they pass fewer or no shipping

costs onto consumers. Displaying trust assurance seals in 2006 provides the retailer price premium yet it has no impact on price in 2001. This is because more consumers became security conscious and the effects of assurance seals on the price were recognized.

Based on the theories of resource-based view (RBV), IT business value, and competitive dynamics, the third essay examines the factors that affect cross-channel capabilities and competitive actions in the apparel industry in the U.S. We have collected a longitudinal dataset on public apparel companies during period of 1995 to 2007. The empirical results reveal that both IT assets and a balanced IT-asset portfolio are positively related to cross-channel capabilities. The level of the financial resources positively moderates the relationship between IT assets and cross-channel capabilities. We find IT assets increase the frequency and broaden the types of firm actions. The effects of cross-channel capabilities on firm actions are mixed. While market-oriented capabilities such as e-commerce and multi-channel cross-selling capabilities broaden the types of market actions, operation-oriented capabilities such as cross-channel fulfillment narrow the range of a firm's market actions. The findings of the study provide important implications to mangers in the apparel and other retail sectors.

CHAPTER 1

INTRODUCTION

In recent years, e-commerce has emerged as the fastest growing sector of the U.S. marketplace. Despite the contraction in the high-tech industry during the recent recession, firms have continued to enter and expand their presence in e-commerce, and consumers have increased the number of purchases made online. For instance, the total e-commerce sales for 2006 were approximately $108.7 billion, an increase of 23.5 percent from 2005 (U.S. Census Bureau 2007). Both buyers and sellers benefit from this new retail channel from reduced search costs. There is evidence that e-commerce provides benefits to consumers in terms of lower prices, increased access to information and increased choice and it also provides benefits to retailers in terms of extended store reach, lower transaction and advertising costs, and enriched interactivity capability. However, consumer and company behaviors in e-commerce are not the same as in the offline setting.

First, when dealing with a virtual (unseen and unfelt) retailer, consumers are more concerned about the security or trustworthiness of Internet shopping. According to European Opinion Research Group (2004), the principal consumer concerns about Internet shopping are security of payments (58%), ability to make warranty claim or get refund (37%), and aspects of delivery (34%). The decision making of consumers in online and offline channels cannot be the same. E-commerce requires a change in the traditional shopping behavior processes, including information search, purchase method, and order fulfillment. Price search engines, for example, are widely used to identify

lowest prices retailers but this does not necessarily lead to the lowest priced products being purchased. Research suggests that consumers use the search engines as an initial screening mechanism but then apply other criteria than lowest price in making their purchase (Ellison and Ellison 2004). The increased availability of information through the Internet would generally have an unambiguous benefit to consumers. The Internet can also play a price comparison and information discovery role so that consumers enter traditional retailers more informed. Consumers can educate themselves about features and prices online, potentially leading to final price improvement. However, increased availability of information may create distortionary incentives for sellers, either in information provision, or such that sellers focus on investment on the characteristics that are now easier to assess (Bar-Isaac et al 2005). Moreover, the established mechanisms built around in-store ambience such as sight, display, smell, tough, and human contact are lost. And e-commerce also separates more clearly "order placement" from "order fulfillment".

Second, early views that the Internet would provide a "frictionless" competitive market have not been realized. Empirical research suggests the continued existence of price dispersion on the Internet. Lee (1998) finds that prices for used cars sold via online auction are higher than conventional auction. Bailey (1998) studies prices for books, CDs and computer software in Internet and conventional outlets during 1996 to 1997, and finds that the prices are higher on the Internet than in conventional outlets. Brynjolfsson and Smith (2000) analyze two categories of homogeneous products – books and CDs – based on individual price observations collected from Feb 1998 to May 1999. They find prices on the Internet are lower than prices in conventional outlets. Clay et al. (2002) find

that average prices on both online and physical stores are similar in 1999, but prices are significantly differentiated for online stores. Clemons et al. (1998) explore the online travel industry and find that tickets prices offered by online travel agents vary greatly. Recent longitudinal analyses on price dispersion suggest that online price dispersion is a persistent phenomenon.

E-commerce also provides the capability to transform traditional tasks and activities and the associated costs within the retail channel (Burt and Sparks 2003). A range of business models have been developed to take advantage of the different cost structures of Internet retailing and new opportunities to interact with customers. Many stores operate in both traditional and online mode and are encouraging customers to make use of both channels, for example by offering order online and pick up in store options. According to a survey in the Economist (2004), an increasing number of consumers now research their purchases online before buy them in conventional stores. For instance, three out of four Americans start shopping for new cars online, even though most end up buying them from traditional dealers. The difference is that these consumers arrive at the showroom with better information about the car and best available deals. Such complementarities between the online and offline shopping can also work in the other direction, where traditional stores may be used as "show rooms". Traditional retailers have responded to the growth of Internet sales by successfully developing their own online business. Yet, quantitative empirical studies concerning the impact of adopting the Internet and innovation through this channel on the performance of traditional retailers are scarce. This lack of knowledge can be attributed to a lack of systematic establishment-level data on firms' Internet usage.

This dissertation examines issues that span the process of electronic commerce, with an aim to provide a better understanding of consumer behavior and firm strategies in electronic markets. We concentrate on the business to end-consumer (B2C) rather than the wider perspectives of e-commerce that would incorporate the business-to-business (B2B) market. The starting phase of my dissertation is to investigate online customer satisfaction and determine the factors that keep customers coming back. Subsequently, a part of my dissertation has been dedicated to pricing strategies of online retailers. The final part of this dissertation is geared toward IT-induced supply chain innovations.

The dissertation is organized as follows. Chapter 2 investigates whether and how the quality of service provided by online retailers could shape a customer's repurchase decision in the presence of information asymmetry. Chapter 3 examines online pricing strategies of B2C retailers. Chapter 4 introduces the proposed investigation of the links between internet-related management innovations and firm performance.

CHAPTER 2

ONLINE CUSTOMER SATISFACTION IN THE FACE OF UNCERTAINTY: EVIDENCE FROM THIRD PARTY RATINGS

Introduction

The recent years have seen tremendous growth in electronic commerce applications. Total retail e-commerce sales for 2006 were approximately $108.7 billion, an increase of 23.5 percent from 2005. The e-commerce share of overall retail sales, however, remained modest at 2.8 percent in 2006 (U.S. Census Bureau 2007a). Numerous online retailers are investigating better ways to attract customers and support their online operations. Yet, surveys of online customers by the International Customer Service Association (ICSA 2005) continue to indicate that a significant percentage of customers were not satisfied with their online purchase experience. What went wrong? What are the major determinants of online customer satisfaction? Clearly, more research is needed to better understand what affects customer evaluations of their online experience and their online satisfaction.

One unique feature of e-commerce is the temporal and spatial separation of buyers and sellers (Lucking-Reiley 2000). Without being able to physically examine the product as well as the retailer, consumers face a high degree of uncertainty (Ba et al. 2003, Sun 2006, Pavlou et al. 2007): uncertainty about the product and uncertainty about the retailer. First, when consumers make an online purchase, they do not have perfect information on product quality. In the traditional business setting, people might get to know the quality of products by looking, touching, and feeling. When viewing a product

online, on the other hand, the traditional way to acquire information regarding the true quality of the product is no longer available to consumers. Therefore, product uncertainty may become a particularly important dimension in a consumer's online purchase decision, depending on the degree of incomplete information associated with the product.

Second, retailer uncertainty is much more pronounced in electronic markets than in traditional physical settings. The Internet has significantly lowered the entry barrier in the online retail industry. Consequently, the number of retailers has increased substantially. There are honest and reputable retailers as well as fly-by-night opportunists. While a high quality retailer will reliably deliver products as promised, a lemon retailer might collect payment without delivering products, deliver products of lower quality than promised, or fail to address customer concerns and inquiries. According to the European Opinion Research Group (2004), the ability to make warranty claims or get a refund (38%), and aspects of delivery (36%) are the principal consumer concerns about online shopping. Both uncertainties have been considered a major barrier to online transactions (Ba et al. 2003). Using data collected from an online shopbot (BizRate.com), we investigate the impact of product uncertainty and retailer uncertainty on a consumer's evaluation of his online experience, which ultimately affects a retailer's online strategy.

Although the aforementioned uncertainties pose a challenge for online retailers, appropriate measures can be taken by retailers to mitigate those uncertainties. In this essay, we focus on three retailer characteristics that prior research has shown as influencing customer satisfaction: customer service, website design, and pricing. We

examine not only the direct effect of these retailer characteristics on customer satisfaction, but also whether these characteristics play a different role with different levels of product uncertainty and retailer uncertainty. For example, when a product involved is a search product, does customer service still matter? Does website design matter more for experience goods than search goods? Is customer service more important when the retailer is less known? In short, we investigate the exact role these retailer characteristics play in the relationship between uncertainty and customer satisfaction. A systematic exploration of how retailers can manage their characteristics to mitigate the negative effects of uncertainty on customer satisfaction will shed light on how to utilize these variables to shape a firm's online strategy and adjust investments in the future.

Our findings demonstrate that uncertainty has negative influences on customer satisfaction, wherein customers are more concerned about retailer uncertainty than product uncertainty. Service quality, website design, and pricing also play important roles in affecting consumer satisfaction towards online retailers. These three factors could be strategically managed by retailers to mitigate uncertainty faced by online shoppers. For example, through facilitating communications of important product information, website design can mitigate the negative impact of product uncertainty. Companies deploying service online must understand that their website is not only an interface with their customers, but also an information system that embeds their business processes. This implication is especially critical for retailers selling goods with more experience attributes. Service quality, on the other hand, is shown to mitigate the negative impact of retailer uncertainty. In the face of retailer uncertainty, customers

generally shop only a few online stores (Johnson et al. 2004). Therefore, our results imply that new or less-known retailers need to provide reliable service quality to ease concerns about retailer uncertainty, thus placing themselves in a consumer's consideration set. Our findings also reveal that higher price signals higher retailer quality; that is, consumers are willing to pay a price premium to get certain quality assurance.

The essay is organized as follows. Section II provides the conceptual model and theoretical considerations for our analysis. In Section III, we outline a general econometric model to analyze the impact of various factors on customer satisfaction. Section IV describes the data. Section V discusses the results based on the panel data estimations. We conclude the essay in Section VI.

Theoretical Development

Much research has been done to understand what motivates consumers to choose among online retailers (e.g., Kotha et al. 2004, Pan et al. 2002, Smith et al. 2000, Wolfinbarger and Gilly 2003). When it comes to shopping online, the consumer's satisfaction is derived not only from the characteristics of the product but also that of the retailer: how easy is it to find the necessary product information? What kind of customer service does the customer receive? In this essay, we focus on the role of product and retailer uncertainty on the customer's evaluation of his online shopping experience and the measures which retailers can deploy to mitigate uncertainty.

Product Uncertainty and Customer Satisfaction

Product characteristics are important factors in the consumers' ability to ascertain the quality of products online, which might, consequently, affect their shopping

decisions. Nelson (1970, 1974) classifies products into two categories: search goods and experience goods. The quality of search goods can be evaluated before purchase whereas the quality of experience goods can be ascertained only after purchase. For the online environment, Lal and Sarvary (1999) define two types of product attributes: digital attributes, which can be easily communicated on the web, and non-digital attributes, for which physical inspection of the product is necessary. For example, the quality of commodity products such as stock shares and paper clips can be clearly and contractually articulated and conveyed online due to the digital attributes of the products. Touching and feeling a product becomes unnecessary. On the other hand, products such as a work of art have a strong "look and feel" aspect to the product quality because of the non-digital attributes of the product, and will be highly impacted by information asymmetry. Although Nelson's classification (1970) in traditional markets cannot be directly applied to electronic markets, search goods tend to have more digital attributes whereas experience goods tend to have more non-digital attributes. In this study, we integrate the Lal and Sarvary classification with the Nelson classification of goods and consider those goods with predominantly digital attributes search goods. Experience goods, on the other hand, demonstrate predominantly non-digital attributes and their quality (e.g., the fit and texture of a pair of trousers) is explored through physical presence.

The major difference between search and experience goods lies in the level of uncertainty with respect to the quality of goods prior to purchase. For experience goods, matching heterogeneous products exactly to consumers' personal tastes is relatively hard. Ratchford (1982) formalizes the mismatch between the product purchased and personal taste as a major component of consumers' welfare loss. A higher level of product

uncertainty is negatively related to customer satisfaction. As a matter of fact, Chaudhuri (1998) find that low levels of perceived risk in products are related to high levels of positive feelings during consumption. Pavlou et al. (2007) find that perceived uncertainty, comprised of product uncertainty and retailer uncertainty, negatively influences a buyer's intention to purchase a product online. Levin et al. (2005) show that online preferences are greatest for books. On the other hand, offline preferences are greatest for clothing, because most product attributes of clothing can not be determined online. We therefore hypothesize:

Hypothesis 1: *Product uncertainty negatively influences online customer satisfaction.*

Retailer Uncertainty and Customer Satisfaction

Consumers' perception of retailer uncertainty is most salient with an unfamiliar retailer. If consumers perceive potential losses associated with a retailer, they are less likely to engage in transactions with the retailer. The retailer quality uncertainty, however, is less when a consumer is transacting with a well-known, well established retailer, such as Amazon.com. Previous research has shown that highly familiar brands are more likely to be chosen over less familiar brands (Baker et al. 1986, Nedungadi 1990). The influence of retailer uncertainty need not be associated with the product quality. Even when the product involved is a search product, there is still the uncertainty about the retailer's reliability in terms of delivering the product or honoring service promises. Bauer (1960) argues in a seminal article that consumers are willing to pay a premium to familiar brands in order to avoid risks in their purchasing decisions. He notes that recognition of the store where the purchase is made may reduce the perceived risk of

the transaction. He further points out that such recognition leads to a reduction in uncertainty, independent of the quality of the product.

When consumers interact with an unknown retailer, the level of trust the consumers have towards the retailer may be considerably lower. Researchers believe this is a major reason why brand name retailers can command a higher price than unknown ones for the same product offered online (Smith and Brynjolfsson 2001, Clay et al. 2002). The lack of trust towards unknown retailers, and the consequent uncertainty felt by the consumer, may adversely affect a consumer's shopping experience. Therefore, we hypothesize that:

Hypothesis 2: *Retailer uncertainty negatively influences online customer satisfaction.*

Direct Effects of Retailer Characteristics on Customer Satisfaction

Prior research has studied the effect of various retailer factors on online customer satisfaction. Concentrating on e-tailing service quality, Wolfinbarger and Gilly (2003) argue that four factors – website design, fulfillment/reliability, privacy/security, and customer service – are strongly predictive of customer satisfaction. Kotha et al. (2004) study the role of online buying experience as a competitive advantage along five dimensions: website usability, customer confidence in the Web business, the selection of goods and services on the site, the effectiveness of relationship services such as virtual community building and site personalization, and the extent of price leadership. They conclude that website usability and product selection can be easily competed away via imitation, whereas superior customer service can lead to a sustainable competitive advantage. Price could also play a role in customer satisfaction. Since online stores are

just a mouse click away, many studies have argued that price is an important factor in a customer's decision making process (Dodds et al. 1991, Lee and Overby 2004). Strong price pressures should lead to convergence in price. However, price dispersion still widely and persistently exists in electronic markets (Clay et al. 2001, Smith and Brynjolfsson 2001, Pan et al. 2002, Ba et al. 2007). Combining the above mentioned studies while integrating their similar dimensions[1], we study online consumer satisfaction from the following three retailer characteristics: website design, customer service, and pricing.

In the online environment, customers interact with a retailer through the retailer's website, which is essentially an information system. Therefore, the design of this information system plays an important role in shaping the customer's shopping experience. Website design has been studied from a usability perspective (Palmer 2002). Neilsen (2000) defines website usability as the ease with which users can navigate through a site. Website usability is affected by the speed with which a website loads and the manner in which information is structured and integrated with the graphic design layout. A user-friendly interface design is critical in influencing traffic and sales (Lohse and Spiller 1998). Brynjolfsson and Smith (2000), for example, find that online retailers who make it easy to find and evaluate products are able to charge a price premium to time-sensitive customers. Szymanski and Hise (2000) suggest that both product information and site design are important in enhancing customer online experience.

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[1] For example, Wolfinbarger and Gilly (2003)'s fulfillment/reliability and customer service as well as Kotha et al. (2004)'s effectiveness of relationship services are all about service. Moreover, Kotha et al. (2004)'s Web site usability is about website design, a dimension studied by Wolfinbarger and Gilly (2003).

Forrest Research notes that the better the search tools provided by the websites, the more customers buy (Hof 2001). More recently, Schlosser et al. (2006) investigate the signaling ability through website investment and find that online purchase intentions are higher at a high-investment website than at a low-investment website. Therefore, we hypothesize:

Hypothesis 3a: *Website design quality is positively related to online customer satisfaction.*

Customer service (e.g., the level of responsiveness, reliability, and the manner of handling customer complaints) traditionally has been considered a key factor that affects customer satisfaction (Kerin et al. 1992, Zeithaml et al. 1988, Goodwin and Ross 1990). In electronic markets, customer service has taken on an additional aspect, namely online service, such as online order fulfillment and order tracking, delivered through technological interfaces such as the Web. Recently, researchers have proposed that online service should be a critical element of a retailer's online competitive strategy. Online service quality is said to help online retailers create differentiation, ease price competition, and increase customer satisfaction (Clemons et al. 2002, Ba and Johansson 2008).

Service quality represents the characteristics of a retailer that are independent of individual product characteristics. Good service can become a sustainable strategic resource, since it is usually hard for industry rivals to imitate. Zhang and Prybutok (2004) demonstrate the importance of service in an online shopping environment. Based on their survey, they argue that service affects not only customer loyalty, but also the perceived usefulness of online shopping. Jun et al. (2004) show in their research that

there is a significantly positive relationship between overall online service quality and customer satisfaction. As a result, e-commerce sites should take service into consideration when being designed. Wirtz and Mattila (2004) find that in a service failure situation, recovery services have a significant effect on post-recovery satisfaction and behavioral intentions (repurchase intent). Therefore, we propose the following hypothesis:

Hypothesis 3b: *Customer service quality is positively related to online customer satisfaction.*

Product price charged by the retailer is also an important factor often examined in the context of a customer's purchase decision (Dodds et al. 1991, Smith and Brynjolfsson 2001). The use of search engines greatly reduces information asymmetry of product price on the Internet. Therefore, anecdotal evidence suggests that customers on the Internet do pay attention to price and have a high propensity to switch because rival stores are just one click away. Reibstein (2002) finds that product price is important in attracting customers to a retailer's website. Martin-Consuegra et al. (2007), in a study of customer loyalty in the service industry, conclude that perceived price fairness positively influences customer satisfaction. Thus, it is expected that price still plays a role in a customer's decision making and satisfaction.

Hypothesis 3c: *Lower price is positively related to online customer satisfaction.*

The Uncertainty-Reduction Effects of Retailer Characteristics

Unlike search goods whose characteristics could be easily communicated on the Web, the attributes of experience goods are hard to describe, which leaves consumers with a high degree of information asymmetry (Nelson 1970, Lal and Sarvary 1999).

Consumers consequently face more severe uncertainty of product quality on the web for experience goods (Weathers et al. 2007). Therefore, when purchasing experience goods online, a consumer usually spends more time comparing the goods and checking other consumers' reviews to obtain information about the quality (Moorthy et al. 1997).

Though unable to communicate fit, texture, or taste over the Internet, online stores of experience goods can take advantage of the use of color, words, images, videos, or consumer reviews to present the product. With an abundance of new kinds of information available on the Internet, consumers can also find and assess non-price attribute information (Ariley 2000, Lynch and Ariely 2000). Klein (1998) proposes that marketers can turn experience goods into search goods by allowing consumers to experience product performance prior to purchase through the use of Internet. Indeed, Lynch and Ariely (2000) find that customer satisfaction and retention were significantly higher for consumers armed with increased quality information. By providing objective information about product attributes and easy access to the information, online retailers could greatly reduce product uncertainty associated with experience goods and enhance customer evaluation of the online purchase experience.

Consumers rely on information delivered by retailers' websites to make inference about product attributes. They must navigate within the structure of a website to find information. Searching for information can be costly to customers in the physical world and it can be equally frustrating online. A retailer's website design, therefore, plays a vital role in how customers locate information online. Thus, clearly designed websites allow the consumer to easily find the necessary information regarding product quality, thus should have more value to the consumer of goods with more experience attributes.

Other researchers have also examined the possibility that different website features have different impacts on a consumer's online experience, depending on the nature of the online interaction. For example, Mithas et al. (2006-07) find that the relative importance of different website features (e.g., content, functionality) in affecting customer loyalty to a website varies depending on the website's domain. Specifically, the relationship between website content and customer loyalty is stronger for information-oriented websites than for transaction-oriented websites. Weathers et al. (2007) demonstrate that online retailers' different website communication practices, such as the use of pictures and display of information from third-party sources, materially affect consumer perceptions of product uncertainty. In addition, they find that the influence of the website communication practices differs by the search or experience orientation of the product. Therefore, we expect the impact of website design on stores of experience goods to be larger. We hypothesize the following:

Hypothesis 4a: *Better website design could mitigate the negative impact of product uncertainty on online customer satisfaction.*

Although others have argued that good customer service by an online retailer can increase customer satisfaction, little prior research has examined whether the effect is the same for well-known retailers and less-known retailers. Retailer quality is more or less an experience attribute. That is, consumers would ascertain retailer quality by trying the retailer out. By eliminating unqualified retailers through experience, consumers form a consideration set and reduce retailer uncertainty for future purchases. The cost of experimenting new stores is expensive, which largely limits the scope of store visit, especially for consumers with prior experience. Johnson et al. (2004), for instance,

suggest that shoppers generally visit few stores online and gravitate toward a preferred site over time, despite the fact that other stores are just a mouse click away. Therefore, for relatively new and unknown retailers, in order to overcome the barriers from higher perceived retailer uncertainty, they must provide high-quality service to reduce concerns about the possible losses from trying out new stores.

In a study to examine industry sectors separately to distinguish drivers associated with overall satisfaction for the online consumers in those sectors, Tih and Ennis (2006) find that several e-service quality dimensions, such as ease of returns and refunds, exhibited sector-by-sector differences, depending on the nature of the website. Therefore, it is reasonable to postulate that the effect of customer service on the relationship between retailer uncertainty and customer satisfaction might also exhibit a difference. Depending on the level of customer service quality, the negative impact of retailer uncertainty will be different. The gap between customer satisfaction toward well-known retailers and that toward less-known retailers will narrow as service quality increases.

Hypothesis 4b: *Better customer service could mitigate the negative impact of retailer uncertainty on online customer satisfaction.*

Although prior research has demonstrated that lower prices could increase customer satisfaction, higher prices are not necessarily always viewed negatively by consumers. When faced with considerable uncertainty, researchers have shown that consumers are willing to pay a higher price to a more reliable and reputable retailer (Ba and Pavlou 2002). Bauer (1960) argues in a seminal article that consumers are willing to pay a premium in order to avoid risks in their purchasing decisions. Wolinsky (1983)

finds that prices can serve as a signal that differentiates the available quality levels. Furthermore, Alba et al. (1997) contend that price sensitivity would be lower online when the quality attributes are more important and when product choices are more differentiated. Therefore, we expect that the price leadership strategy plays a more important role for retailers selling search goods, because the digital attributes of search goods can be easily communicated online. Consumers of search goods do not need to pay more for product quality assurance. On the other hand, for retailers selling experience goods, a consumer may consider higher prices as a signal of higher product quality. We also expect that price leadership strategy is more important for less known retailers, so as to compensate for customers' perceived possible transaction loss. Well-known stores, however, are able to charge a price premium.

Hypothesis 4c: *Online consumers are willing to pay a higher price to reduce product uncertainty.*

Hypothesis 4d: *Online consumers are willing to pay a higher price to reduce retailer uncertainty.*

Figure 1.1 summarizes our research model. We theorize that product uncertainty and retailer uncertainty have a different impact on online customer satisfaction. In addition to their direct impact on customer satisfaction, the three retailer characteristics (i.e., website design, customer service, and pricing) moderate the relationships between the uncertainties and customer satisfaction.

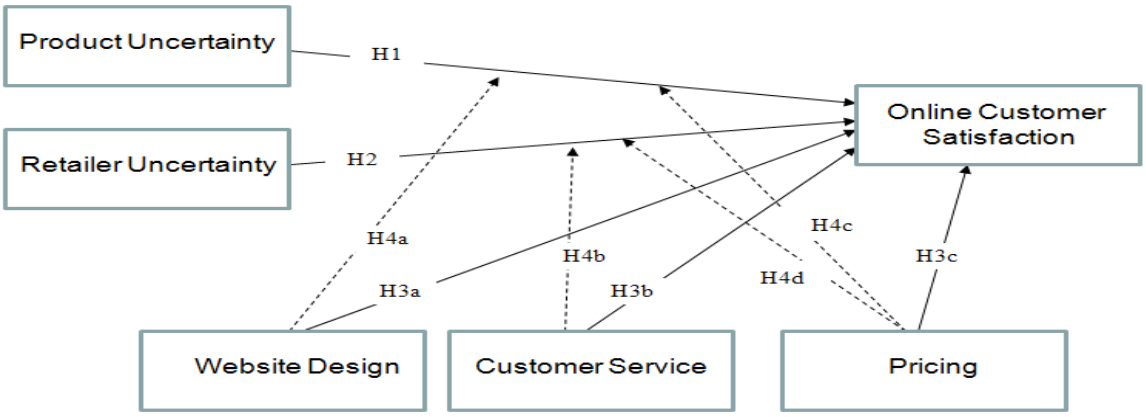

Figure 1.1 Research Model and Hypotheses

The Econometric Model

This research contends that a risk-averse consumer's satisfaction towards his choice of retailer is derived from the characteristics of the online retailer (how easy it is to use the website, whether the retailer is trustworthy, etc.) as well as the degree of uncertainty associated with his purchase decision. Specifically, we assume that the customer satisfaction (*CS*) of consumer *i* derives from the purchase of a product from store *j* is

$$CS_{ij} = \beta_0 + \beta_1 w_{ij} + \beta_2 s_{ij} + \beta_3 p_{ij} + \theta_1 E_j + \theta_2 R_j + \varepsilon_{ij} \qquad (1)$$

where *w, s,* and *p* represent the three retailer characteristics (website design, customer service, and pricing policy), respectively. *E* and *R* represent product and retailer related uncertainty. More specifically, we define (*E*) as a dummy variable that equals 0 for search goods and 1 for experience goods. Consumers can make evaluations of the search goods' characteristics and quality prior to purchase; the quality characteristics of experience goods, however, can be determined only after purchase through physical inspection. This difference embeds the degree of uncertainty the consumer faces when

shopping online. *R* represents retailer uncertainty; the more known the retailer is, the less uncertainty the consumer faces. The disturbance term comprises two parts $\varepsilon_{ij} = v_{ij} + u_j$. The first part, v_{ij}, corresponds to the common stochastic error term, and is assumed to be uncorrelated with the regressors and vary unsystematically across retailers and individual consumers. The second part, u_j, is the so-called retailer-specific effect. It usually varies across retailers but is constant over individual consumers of each retailer. The behavior of u_j determines which estimation method should be used.

The above model only investigates the impact of uncertainty and the direct effects of the three characteristics on customer satisfaction, but it does not capture the possible uncertainty reduction effects of the three retailer characteristics. As we argued in the theoretical development section, online retailers' characteristics could impact consumers' information acquisition behavior, which helps mitigate uncertainty. In order to capture this systematic difference, we interact the dummy variable *E,* which represents product uncertainty, with the variables representing retailer characteristics and add the interaction terms into model (1):

$$CS_{ij} = \beta_0 + \beta_1 w_{ij} + \beta_2 s_{ij} + \beta_3 p_{ij} + \theta_1 E_j + \theta_2 R_j + \gamma_1 E_j w_{ij} + \gamma_2 E_j s_{ij} + \gamma_3 E_j p_{ij} + \varepsilon_{ij} \quad (2)$$

We further add the interaction terms between retailer uncertainty and the three retailer characteristics to the above model to capture the additional effects these interaction terms have on customer satisfaction. The complete model to test for the uncertainty reduction effects is as follows (according to Baron and Kenny 1986):

$$CS_{ij} = \beta_0 + \beta_1 w_{ij} + \beta_2 s_{ij} + \beta_3 p_{ij} + \theta_1 E_j + \theta_2 R_j + \gamma_1 E_j w_{ij} + \gamma_2 E_j s_{ij} + \gamma_3 E_j p_{ij} + \tau_1 R_j w_{ij} + \tau_2 R_j s_{ij} + \tau_3 R_j p_{ij} + \varepsilon_{ij} \quad (3)$$

By checking the joint significance of the γ and τ coefficients, we can see whether and how retailer characteristics (i.e., website design, customer service quality, and pricing) mitigate the relationship between uncertainty and customer satisfaction.

The Data

The data for this study was primarily collected in summer 2005 from BizRate.com, one of the most well-known price comparison sites. BizRate.com, which has been in the business of rating online stores since 1996, collects merchant ratings at "checkout," by asking customers to evaluate their purchase experiences, on a 1 to 10 scale, immediately after completing an online transaction, as well as "after delivery," when the purchase is expected to be received. All together, there are 15 ratings from each customer transaction, with 2 ratings measuring the customer's overall experience and 13 measuring different dimensions of the transaction, such as the ease of finding the product and whether the product delivery was on time. The fifteen ratings collected by BizRate.com are explained in Table 1.1. Rating information is available for each merchant on an aggregate level as well as on an individual consumer level. BizRate.com has repeatedly conducted validity checks on its possible response bias. This has entailed e-mail follow-up to nonrespondents to see whether the answers by the nonrespondents were any different from those who had responded earlier. BizRate.com has reported no noted nonresponse bias (Reibstein 2002).

We collected data for two types of retailers: retailers selling only clothing and those selling books and magazines. By using these two categories, we hope to test our hypotheses of the structural difference of customer satisfaction associated with the degree of product uncertainty between search goods and experience goods. The classification of

clothing as experience goods and books and magazines as search goods is consistent with the classification scheme by Ekelund et al. (1995). Levin et al. (2005) and Rha et al. (2001) have also argued that clothing should be considered high-touch goods because their quality is best evaluated by sight and touch sense. We use this classification to take into account the information aspect of the goods - whether the good has more digital attributes which can be easily communicated on the web, a critical element of product description in online retailing.

Our restriction to retailers selling only clothing or only books and magazines rendered us with only 49 retailers, of which 9 are those selling books and magazines. Mega stores such as Amazon.com, although one of the biggest book sellers online, were not included in our data sample because these mega stores also sell many other products which may fall under either the experience goods category or the search goods category. Their customer satisfaction ratings, therefore, would not let us test the possible systematic differences associated with each product category.

For each retailer, we collected all of the available individual consumer ratings so as to increase the effective sample size and hence the precision of the estimation. Figure B.1 in Appendix B is a screenshot of a BizRate individual consumer's ratings of Barnes & Noble.com. BizRate.com only posts the latest 90 days' of consumer ratings. The resultant data set comprised a cluster sample of online store ratings, with 9957 observations overall. This data is different from the ordinary panel dataset in that it has a retailer dimension and an individual consumer dimension.

Table 1.1 BizRate.com Customer Satisfaction Ratings

Rating	Source	Explanation
Would shop here again	after delivery	Likelihood to buy again from this store
Overall rating	after delivery	Overall experience with the purchase
Ease of finding what you are looking for	at checkout	How easily were you able to find the product you were looking for
Product Selection	at checkout	Types of products available
Clarity of product information	at checkout	How clear and understandable was the product information
Prices relative to other online merchants	at checkout	Prices relative to other websites
Overall look and design of site	at checkout	Overall look and design of the site
Shipping charges	at checkout	Shipping charges
Variety of shipping options	at checkout	Desired shipping options were available
Charges stated clearly before order submission	at checkout	Total purchase amount (including shipping/handling charges) displayed before order submission
Availability of product you wanted	after delivery	Product was in stock at time of expected delivery
Order tracking	after delivery	Ability to track orders until delivered
On-time delivery	after delivery	Product arrived when expected
Product met expectations	after delivery	Correct product was delivered and it worked as described/depicted
Costumer Support	after delivery	Availability/Ease of contacting, courtesy & knowledge of staff, resolution of issue

To reduce the redundancy of the BizRate measures, we subjected the data to a factor analysis to try to find the common factors. An iterated principal factor analysis with a varimax rotation was performed on the 13 attributes measuring specific aspects of a transaction. The results of the factor analysis indicated the existence of three

underlying common factors (Table 1.2)[2]. Customer support, order tracking, on-time delivery, product met expectation, and product availability loaded on Factor 1. This factor reflects the service quality of online retailers after the transactions. Factor 2 is highly related to the design of the website, which determines whether the website is easy to navigate and how easily a customer can find the desired information about a desired product. Factor 3, on the other hand, is mainly focused on the product price and shipping charges, which represents the price advantage and pricing policy of the retailers. The three extracted factors are labeled as customer service, website design, and pricing respectively, which correspond to the retailer characteristics frequently investigated in previous literature. Before using the three factors as predictor variables, we further computed the Cronbach's alpha to check the reliability of each factor. The composite reliability of every factor, as shown in Table 1.2, is well above Nunnally's (1967) $\alpha \geq 0.70$ rule of thumb, which ensures internal consistency and eases our concern of measurement error.

We grouped the variables with high loadings on a factor to construct factor scores by taking the average[3]. The simple factor scores computed by taking the average of the high loading variables have a rather pleasing intuitive property and are frequently highly correlated with the factor scores obtained by the least squares and regression methods (Johnson and Wichern 1998). We further normalized each factor score around zero with standard deviation of one and employed the standardized factor scores, instead of the 13

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[2] The three common factors were retained according to the eigenvalues, as well as the visual check of the scree plot and the residual correlation matrix.
[3] Factor scores were created with the MEAN function in SAS, as suggested by Suhr (2003).

individual dimension ratings, in our empirical estimates. This eliminates the potential multicollinearity problems and greatly facilitates the interpretation of our results.

Table 1.2 Factor Analysis of the BizRate Survey Data

	Components		
Variable	**1**	**2**	**3**
Costumer support	**0.781**	0.254	0.232
Order tracking	**0.743**	0.170	0.234
On-time delivery	**0.739**	0.200	0.214
Product met expectation	**0.653**	0.243	0.222
Product availability	**0.602**	0.385	0.144
Ease of finding product	0.284	**0.792**	0.241
Site design	0.241	**0.718**	0.344
Clarity of product info	0.315	**0.702**	0.335
Product selection	0.277	**0.638**	0.329
Shipping options	0.240	0.298	**0.783**
Shipping charges	0.226	0.211	**0.620**
Price	0.242	0.433	**0.619**
Charges displayed	0.331	0.457	**0.558**
Factor Name	**Customer Service**	**Website Design**	**Pricing**
Composite Reliability	**0.88**	**0.88**	**0.81**

Note: Iterated principle factor analysis with varimax rotation was used.

Since consumers' perception of retailer uncertainty is most salient in an unfamiliar store, retailers that are well-known are generally perceived less uncertain by customers. Moreover, Consumers can make inference about sellers' ability and credibility based on their perceived marketing expenditure (Kirmani and Rao 2000). Higher website traffic reflects the cumulative effects of past marketing strategies and

activities. An online retailer with high website traffic is likely to be considered capable and credible, because maintaining high website traffic entails expensive investment of time, money, and effort. Such a large investment also makes opportunism by the retailer costly. Therefore, we used the inverse of website traffic data as a proxy for retailer uncertainty. The higher the website traffic, the less uncertainty the consumer faces when transacting with the retailer. The data was drawn from Alexa.com. In particular, the three-month average of "Reach per million," which measures how many unique Web users had visited the retailer's website daily on average in the previous three months, was attained in July 2005 for all the merchants whose customer ratings were collected from BizRate. For example, if a site like jcrew.com has a reach of 240, this means that if one took random samples of one million Internet users, on average 240 of them visit jcrew.com. Alexa's three-month average reach is a measurement of daily reach averaged over the previous three-month period.

It is possible that other factors might influence website traffic which can temporarily inflate or deflate the measure for retailer uncertainty. For example, if a retailer runs a promotion, the retailer's website traffic might experience a spike during the promotion. However, given that the Alexa traffic data is averaged over a three-month period, we think the effect of any short-term promotion on a website's "reach per million" would be minimal.

The consumer satisfaction in our model is measured by a multiple-item measure that consists of the two Bizrate.com ratings measuring the customer's overall experience. The first item, "overall rating", asks a consumer to rate his/her overall experience with the purchase. Another item, "would shop here again", asks a consumer about his/her

likelihood to buy again from the retailer. The factor scores were computed by taking the average of the two items and then normalized around zero with standard deviation of one.[4]

A number of control variables were included in the estimations to control for store-specific factors. Sorensen and Stuart (2000) find organizational age significantly affects organizational behaviors, thus we need to control for possible confounding effects of firm age. Alexa.com provides the time when stores first opened their online channels, which we used to calculate the number of years a store had been online up to July 2005 (the month when our data was collected). This variable is named as "online age" for a retailer. A dummy variable called "Channel" is added as a control, which equals 0 for "pure online" stores and 1 for "brick-and-click" stores. Multi-channel retailers could provide better pick-up and return services, more convenient product inspection, and greater consumer trust, which might lead to higher customer satisfaction (Montova-Weiss et al. 2003, Luo et al. 2008). Moreover, a dummy variable of "Public" was included with 1 for publicly traded retailers and 0 otherwise to control for previously documented public versus private effects (see Fuller et al. 2002, Officer 2007). We checked each store against the COMPUSTAT database. If the store is listed in the COMPUSTAT database, it is considered a publicly traded company. The number of total consumer ratings in the previous three months was also collected for each store to control for the factors that motivated consumers to provide feedback. Bizrate.com puts a "Customer certified" seal on its website for stores that committed to proactively receiving customer

[4] The measure is created using the MEAN function in SAS. In our empirical tests, we also tried the two individual items separately and the estimation models yielded qualitatively similar results.

feedback and to providing satisfactory customer service, which induces customers to form expectations about the store's quality. Odom et al. (2002), for example, find a significant effect of Web assurance seals on consumer trust. Therefore, we added a dummy variable "Customer certified" with 1 for stores with the seal and 0 otherwise in our estimation.

The descriptive statistics of the variables (before standardization) used in our empirical models are listed in Table 1.3.

Table 1.3 Descriptive Statistics and Correlations

Constructs	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Customer Satisfaction	8.09	2.41										
2. Website Design	8.64	1.41	.37									
3. Customer Service	8.12	2.22	.83	.40								
4. Pricing	8.29	1.67	.34	.36	.59							
5. E (product dummy)	-	-	-.11	-.11	-.09	-.16						
6. Website traffic	135.19	279.02	.07	.05	-.03	-.04	.01					
7. Number of Ratings	203.18	279.40	-.15	-.18	-.02	-.10	.10	.03				
8. Online Age	7.61	2.41	.06	.05	-.03	-.05	-.05	.44	.02			
9. Channel	-	-	.10	.11	-.02	-.03	.08	.34	-.32	.61		
10. Public	-	-	.10	.10	.00	.05	-.05	.38	-.37	.34	.64	
11. Customer Certified	-	-	-.03	-.03	.03	.01	.06	.08	.21	-.03	-.11	-.09

Empirical Results and Discussions

One possible approach for our data estimation is pooled ordinary least squares (POLS) which treats observations as being serially uncorrelated for a given retailer, with homoscedastic errors across retailers and individual consumers. However, many retailer-specific characteristics, such as the retailer's financial status and organizational culture,

typically exist in the panel data set and they are difficult to observe or measure. If the unobservable retailer-specific characteristic is not taken into account, results from POLS might be biased. The Breusch-Pagan test ($\chi^2(1) = 21.58$, $p < .01$) suggests that there is strong evidence of the retailer-specific effects in our dataset. Thus cluster-sample techniques are employed to fit our dataset.

We account for potential store-specific errors by directly controlling for each store characteristic, such as the online age, number of ratings, whether the retailer is a publicly traded company, etc. Although these controls cannot fully rule out the possible problem of endogeneity, they increase our confidence that our results are not an artifact of the difference in unobserved characteristics in retailers. Moreover, since the parameter estimates from both the fixed effects model and the random effects model we ran are similar in sign, magnitude, and significance, we are quite confident about the robustness of our results (see Table A.1 in Appendix A). We also examined the possibility of multicollinearity, especially the possibility of multicollinearity between the three common factors. A pairwise correlation analysis ensured that no two regressors were highly correlated. The VIF statistics (Belsley et al. 1980) in the preliminary estimations suggested that multicollinearity was not a concern for most of the variables except the interaction term between pricing and product uncertainty. To address heteroscedasticity and the correlation of errors within retailers, the final models we ran are random effects models with robust standard errors clustered by retailer.

Table 1.4 Effects of Uncertainty and Retailer Characteristics

	Model 1	Model 2	Model 3	Model 4
Constant	0.061 (0.072)	0.046 (0.088)	0.054 (0.083)	0.06 (0.08)
Website design	0.041*** (0.009)	-0.019 (0.026)	-0.014 (0.027)	-0.003 (0.016)
Customer service	0.822*** (0.021)	0.854*** (0.023)	0.826*** (0.018)	0.830*** (0.020)
Pricing	0.024*** (0.009)	0.046 (0.047)	0.049 (0.037)	0.022*** (0.008)
E (Product uncertainty)	-0.014 (0.024)	-0.014 (0.035)	-0.025 (0.038)	-0.033 (0.025)
R (Retailer uncertainty)	-0.023* (0.013)	-0.027* (0.015)	-0.040*** (0.015)	-0.040*** (0.015)
Uncertainty-Reduction Effects				
Website design * E	--	0.065** (0.027)	0.065** (0.029)	0.053*** (0.017)
Customer service * E	--	-0.031 (0.032)	-0.014 (0.025)	-0.018 (0.026)
Pricing * E	--	-0.028 (0.048)	-0.029 (0.039)	--
Website design * R	--	--	-0.013 (0.011)	-0.013 (0.011)
Customer service * R	--	--	0.068*** (0.017)	0.068*** (0.017)
Pricing * R	--	--	-0.034*** (0.011)	-0.034*** (0.012)
Control Variables				
Number of ratings	ns	ns	ns	ns
Online age	ns	ns	ns	ns
Channel	ns	ns	ns	ns
Public	ns	ns	ns	ns
Customer certified	-0.096*** (0.033)	-0.075*** (0.027)	-0.066** (0.028)	-0.065** (0.028)
R^2 (adjusted)	0.70	0.71	0.72	0.72
χ^2 statistics for product uncertainty interactions	--	11.25**	10.84**	9.95***†
χ^2 statistics for retailer uncertainty interactions	--	--	18.61***	18.07***

Note: *, **, *** = significant at 10%, 5% and 1% level. Standard errors are reported in parentheses. † The χ^2 statistic is computed for the two remaining product uncertainty Interaction terms.

Table 1.4 reports the final estimation results. Model 1 is a baseline model, which tests the direct effects of uncertainties and retailer characteristics. Model 2 examines the product uncertainty reduction effect of the three retailer characteristics. Model 3 is the full model that jointly examines the effects of uncertainties on customer satisfaction and the product as well as retailer uncertainty reduction effects of the retailer characteristics. Our analysis will mainly focus on the results of Model 3. The tests for the moderating effects of retailer characteristics used Wald-statistic (Green 2002), testing whether the uncertainty reduction effects exist on a consumer's shopping experience. The Wald test statistics indicate that the three interaction terms between the product dummy and the retailer characteristics are jointly statistically significant ($\chi^2(3) = 10.84$, $p < .02$), suggesting that the retailer characteristics do function as a moderator on the relationship between product uncertainty and customer satisfaction. The three interaction terms between retailer uncertainty and retailer characteristics are also jointly statistically significant ($\chi^2(3) = 18.61$, $p < .01$).

As suggested by the VIF statistics, there is a concern in Model 3 about the possible multicollinearity problem between pricing and product uncertainty, which could be the reason for the variable of pricing being insignificant. A common practical remedy is to drop variables suspected of causing the problem (Green 2002, p. 58). Model 4 takes care of the multicollinearity problem by dropping the insignificant interaction term between pricing and product uncertainty.

Customer Response to Uncertainties and Retailer Characteristics

The coefficient of product uncertainty in Model 1 (b = -.014) is an average effect of product uncertainty across stores with different levels of website design. When we

control for the product uncertainty reduction effects, we find that the impact of product uncertainty depends on the level of website design.[5] The Wald statistic ($\chi^2(4) = 12.35$, $p < .02$), testing the joint significance of θ_1, γ_1, γ_2 and γ_3, validates the significant role of product uncertainty. Assuming website design to be its minimum, the impact of product uncertainty will be -0.352 (see the left panel of Figure 1.2, graphed based on Model 3). Retailer uncertainty also negatively impacts online customer satisfaction, as confirmed by the Wald statistic ($\chi^2(4) = 20.60$, $p < .01$) which tested the joint significance of θ_2, τ_1, τ_2 and τ_3. The finding suggests that well-known retailers tend to fare better with consumers. This result goes against the earlier notion that the Internet is leveling the playing field for big and small companies. We can see that the well-known retailers, which normally have more website traffic, still have a competitive edge over those less known.

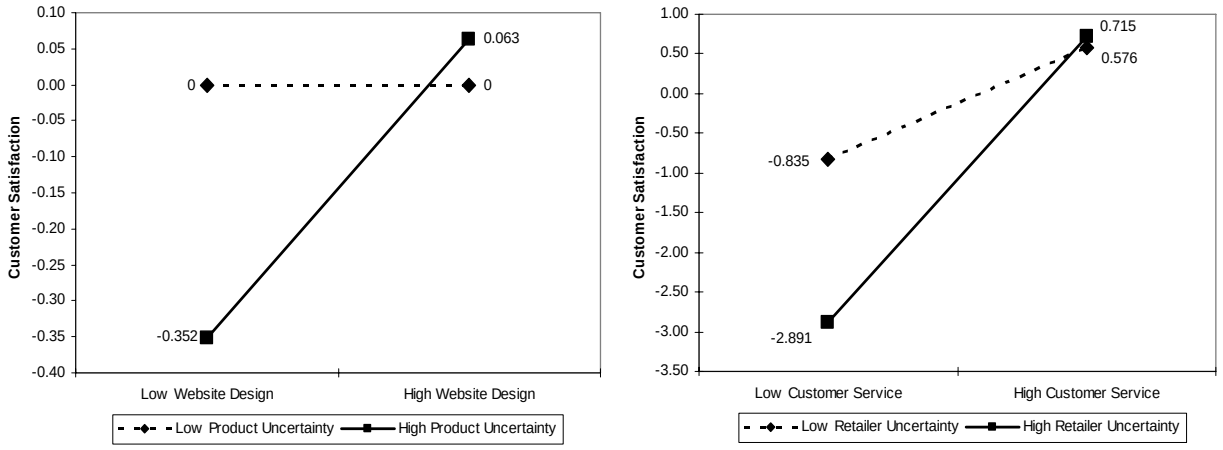

Figure 1.2 The Uncertainty Reduction Effects of Retailer Characteristics

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[5] The partial effect of product uncertainty on customer satisfaction is mathematically $\theta_1 + \gamma_1 w + \gamma_2 s + \gamma_3 p$, where w, s, and p are website design, customer service, and pricing, which are normalized variables with mean zero and whose minimums is negative. Both γ_2 and γ_3 are not significant, therefore the partial effect of product uncertainty is $\theta_1 + \gamma_1 w$.

The Wald statistic was 32.19 ($p < .01$) for website design, 5111.7 ($p < .01$) for customer service, and 16.05 ($p < .01$) for pricing, thereby suggesting significant effects of the three retailer characteristics on online customer satisfaction. It is of interest to further investigate how the three retailer characteristics affect customer satisfaction. As the results suggest, customer service has a statistically significant direct effect on customer satisfaction, providing support for H3b. Pricing seems to have no impact on customer satisfaction in Model 3. This insignificant result is likely due to the possible multicollinearity problem; therefore we dropped the interaction term between pricing and product uncertainty and ran the model again (Model 4 in Table 1.4). Pricing now has a significant direct effect, validating H3c. Website design doesn't have a direct impact on customer satisfaction after we control for the uncertainty reduction effects. H3a is therefore not supported. In sum, the main determinant of online customer satisfaction is customer service, which has a coefficient of 0.826 (Model 3 in Table 1.4). Such a coefficient indicates that, holding other variables in the model constant at their mean levels, one standard deviation increase in service quality will raise customer satisfaction by 0.826 standard deviation. The result is consistent with the finding by Ariely and Carmon (2000), who contend that customer service provided at the end of a shopping process is critical in influencing the likelihood of repeat purchase. The effect of price is relatively small, with the coefficient being 0.022 (Model 4 in Table 1.4). We now turn to investigate the uncertainty-reduction effects of the three retailer characteristics on customer satisfaction.

The Uncertainty-Reduction Effects of Retailer Characteristics

Website design has virtually no effect on customer satisfaction for retailers of search goods, but the effect becomes large in the experience goods category, as hypothesized ($b = .065$, $p < .03$). This result provides support for H4a; that is, by reducing search cost for product quality information, better website design is able to alleviate the negative influence of product quality uncertainty. As shown in the results of the factor analysis, the factor of website design includes such ratings as ease of finding product, site design, and clarity of product information. A consumer usually has a clear idea of what to buy with respect to search goods. For example, she might already know the title and/or author of the book she is interested in and she could easily find the book using the search engine provided by the website. On the contrary, before she decides to buy clothing, the consumer usually will compare different styles, colors and so on. This requires an efficient virtual channel to convey all kinds of product information available. Indeed, consumers on average view significantly more web pages in stores selling clothing than those selling books and magazines in our dataset ($b_{search}=3.89$, $b_{experience}=5.00$, $t = 1.73$, $p < .1$).[6] Thus, clear layout and variety of selection on the website will reduce the customer's search cost for quality information and can help consumers reduce the welfare loss from the mismatch between products purchased and his/her personal tastes. The left panel of Figure 1.2 demonstrates the uncertainty-reduction effect of website design. The negative impact of product uncertainty is

[6] Alexa.com also provides information on three-month average page views, which is a measure of the number of unique pages viewed per user per day for each website averaged over the previous three-month period.

prominent for retailers with bad website design, but customer satisfaction gradually increases as retailers improve their websites.

Consumer evaluation of service quality does not vary across retailers selling different products. Customer service is important to consumers, regardless of whether they are buying search goods or experience goods. Given that service includes such transaction dimensions as order tracking and on-time delivery, this result makes sense: even if a consumer is buying a search good such as a book, on-time delivery is still important.

What is especially revealing is that the interaction between retailer uncertainty and customer service is significantly positive ($b = .068$, $p < .01$). The marginal effect of retailer uncertainty on customer satisfaction depends on the retailer's customer service quality[7], confirming H4b. As customer service improves, the impact of retailer uncertainty becomes smaller. Therefore better service may, to a certain degree, alleviate the adverse impacts of high uncertainty of an unknown retailer and enhance its competitiveness in the online market. The right panel of Figure 1.2 demonstrates the mitigating effects of customer service. For a sharper contrast, low and high retailer uncertainties are represented by its minimum and maximum, respectively. Low and high customer service are also graphed using its minimum and maximum. As shown in Figure 1.2, the gap between retailers with less uncertainty and those with more uncertainty is quite large (2.056) but it narrows as the customer service quality improves.

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[7] Retailer uncertainty is a continuous variable, so its marginal effect is $\partial CS / \partial R = \theta_2 + \tau_1 w + \tau_2 s + \tau_3 p$, where w, s, and p are website design, customer service, and pricing, respectively. Since τ_1 and τ_3 are both insignificant, the marginal effect depends on the level of customer service.

The interaction between the product dummy and the pricing factor is negative, but not significant (b = -.028). H4c is not supported. On the contrary, the interaction term between retailer uncertainty and pricing is negative and statistically significant (b = -.034, $p < .01$), supporting H4d. These results suggest that those well-known retailers that present less uncertainty are more attractive; consumers, therefore, are willing to pay a price premium to transact with them.

Table 1.5 summarizes the main results of the study.

Table 1.5 Summary of the Effects of the Uncertainty and Retailer Characteristics

		Retailer Uncertainty	
		High	Low
Product Uncertainty	High	• Customer satisfaction, ceteris paribus, is lowest when both product uncertainty and retailer uncertainty are high (H1 and H2). • Customer service has a strong moderating effect on the negative relationship between retailer uncertainty and customer satisfaction (H4b). • Pricing moderates the relationship between retailer uncertainty and customer satisfaction (H4d).	• Customer satisfaction is lower with high product uncertainty (H1). • Website design plays an important role in mitigating the negative impacts of high product uncertainty by facilitating search for quality information (H4a).
	Low	• Customer satisfaction is low when faced with high retailer uncertainty (H2). • Customer service plays a major role in customer satisfaction (H3b) and is especially important when consumers face high retailer uncertainty (H4b).	• Customer service is important (H3b). • Customer satisfaction is higher with low price (H3a); price competition is stronger.

Implications and Conclusion

There is no doubt that the Internet provides a very effective and cost-efficient way to create, collect, and disseminate information. However, searching for quality information can be costly in the physical world and equally frustrating online. As a consequence, the problem of imperfect quality information does not disappear in the new Internet economy as has been claimed previously (see, e.g., Kuttner 1998). Due to the separation of buyers and sellers in e-commerce, consumers face much more severe uncertainty. Online retailer characteristics may have different influences on the customer's online purchase decision, depending on the degree of uncertainty associated with the product and retailer quality. In order to effectively manage customer retention in the face of intense online competition, it is important to understand and assess the factors influencing customer satisfaction and preference.

Key Contributions

This study makes several important contributions to the research literature on online customer satisfaction. First, our study empirically investigates the impacts of uncertainty on a consumer's evaluation of online purchase experience by using real world observations. The data comes from real consumers based on their real transaction experiences. This gives our study results more generalizability than studies that use subjects who are not asked to engage in real transactions.

Second, while prior research has examined the effect of uncertainty on online customer shopping behavior (Pavlou et al. 2007), our research is one of the first to separate uncertainty into product uncertainty and retailer uncertainty. Our results indicate that these two types of uncertainties indeed play a different role in online customer

satisfaction. Consumers are more concerned about retailer uncertainty than product uncertainty.

Third, our study explores the differences retailer characteristics have on customer satisfaction. Although previous studies have examined the importance of various factors for online customer satisfaction, our study directly compares multiple factors, namely pricing, website design, and customer service, and pinpoints the most important one: customer service. These differences suggest that retailers should tailor their online strategy according to their online brand status. Moreover, we provide empirical evidence that customer service is especially critical for less-known retailers.

Finally, by incorporating the uncertainty-reduction effects of retailer characteristics in our research model, our study highlights the importance of understanding customer satisfaction in different contexts: consumer evaluations differ for retailers selling search goods and experience goods, mainly because of the existence of product uncertainty. The nature of the online products (search vs. experience) should be taken into account when retailers develop their online competitive strategy.

Research Implications

Although website design has an insignificant effect on customer satisfaction for retailers selling search goods, it becomes significant in the experience goods category. The results suggest that clear layout and easy navigation on the website could reduce search cost for quality information, reduce the mismatch between the product purchased and personal taste, and consequently increase his satisfaction. This finding provides guidance to retailers when they develop their online strategy and decide how to allocate their resources. In online shopping, search costs are generally represented as web page

loading time, number of mouse clicks to find the right product (Hoque and Lohse 1999), information presentation (Ariely 2000, Lynch and Ariely 2000), category unfamiliarity, and depth (Galletta et al. 2006). Therefore, online retailers, especially those selling goods with mostly non-digital attributes, should focus on these aspects of online search cost when designing their website. It is also consistent with a previous study on virtual product experience (VPE). Jiang and Benbasat (2005) contend that VPE technology can enable potential customers to experience online products virtually, which allows consumers to better understand and evaluate experience goods. Indeed, the highest shares in online retailing were observed in books and magazines, music and videos, and electronics (product categories with most search attributes). The lowest shares were observed in products with most experience attributes, such as clothing and apparel, food, and drugs. The gap, however, is getting smaller over time as both sellers and buyers experiment with online methods for different product types. Many retailers of apparel, for example, re-launched their e-commerce websites recently to make transaction and search activities simple (Luo et al. 2008). Taking book/magazine and clothing as an example, the gap in their respective share in online retailing had reduced from 23.1% in 2001 to 4.3% in 2005 (U.S. Census Bureau, 2007b).

Our study indicates that customer service can mitigate the negative impact of retailer uncertainty. Therefore, for relatively new and unknown retailers, in order to attract and retain consumers, they must provide superior service to reduce concerns about possible loss resulting from consumers trying out new stores. Combined with the large direct effect of customer service, these results highlight the importance of service provision no matter what product a retailer sells and justify the investment in service

technology. To the best of our knowledge, no prior research has examined consumers' satisfaction towards online retailers with different degrees of uncertainty, and our research will shed light in that regard.

From a practical point of view, our research provides investment guidance to firms in their creation of and upgrades for their online retailing business. A website can offer different capabilities and focus on different aspects of business operations. Many companies, however, are financially constrained in practice in terms of what online features to focus on. It is, therefore, important to identify those features that are critical to customer satisfaction. In addition to interface design factors identified by prior research, such as site aesthetics, graphics presentation, and visual effects, our research results bring to the foreground the importance of service: procedural and process design capabilities that deliver service to customers are extremely important in achieving customer satisfaction. Companies deploying service online must understand that their website is not only an interface with their customers, but also an information system that embeds their business processes. Having smooth and flexible website processes means seamless system integration. For example, the website needs to be integrated with the company's inventory system so customers can check the availability of products; with the order tracking system so customers can check their order status, etc. Therefore, presenting a "pretty face" (i.e., website design) is only a small part of an online retailer's competitive effort. How the whole system is designed and what services to deliver through technological capabilities ultimately determine how satisfied the customers are.

Finally, we find that online customers prefer the well-known retailers in the face of uncertainty. This result is striking: it demonstrates to firms that brand building is still

important in today's competitive environment, even though many have believed that the Internet levels the playing field. A strong retailer brand signals lower risks to consumers, thus attracting risk-averse consumers to the site.

Limitations and Suggestions for Future Research

As with any research, this essay comes with a number of limitations which open opportunities for further exploration in future research. First, we studied stores selling two types of products (i.e., books/magazines and apparels) in order to differentiate the degree of product quality uncertainty, but both products are relatively low price items. It would be fruitful to study whether the uncertainty-reduction effects of retailer characteristics become more salient when high-ticket items are included. The additional dimension of price would present an even richer research context to study the impact of uncertainty and how retailers can manage their strategy to reduce the uncertainty.

Second, the study analyzes uncertainty and customer satisfaction using the ratings data provided by Bizrate.com. Results based on comprehensive scales developed by academic researchers would be a plus. Therefore, this essay calls for more research on measurement of service quality delivered through websites. There is an increasing body of research that tries to develop measurements of web and service quality. For instance, Lociacon et al. (2000) established a scale called WebQual with 12 dimensions, which are geared toward measures for determining website quality. Wolfinbarger and Gilly (2002) develop a scale called .comQ, which contains four factors: website design, reliability, customer service, and privacy/security. Our factor labeled as customer service corresponds to reliability and customer service in .comQ. Zeithaml et al. (2001) develop e-SERVQUAL to measure e-service quality. The scale includes seven dimensions:

efficiency, reliability, fulfillment, privacy, responsiveness, compensation, and contact. Our factor of website design corresponds to efficiency, that is, the ability of the customer to get to the website, find the desired product and information associated with it, and check out with minimal effort. The factor of customer service is correspondent to fulfillment, responsiveness, compensation, and contact. A theoretical framework that incorporates the previous studies and delineates what customer service in the online retailing environment really entails would provide guidance to future research on online customer service and make the measurement more consistent.

Furthermore, in recent years, there has been a growing interest in services management. Many have realized that services could be used by firms as a defense against the commoditization of goods and as a strategy for productivity, growth, and retention. In a recent editorial in Information Systems Research, Rai and Sambamurthy (2006) call for more research to examine the impact of IT innovations for services management. We believe there are several opportunities in which future research could strengthen the results of our study.

Service has different dimensions, and the processes delivering different services online can also be different. Levitt (1976) draws upon manufacturing sources in using the words "standardized" and "customized" to define the poles of a service process continuum whereas Shostack (1987) uses "complexity" and "divergence." In this research, we only studied service as an aggregate measure to alleviate multicollinearity concerns. However, conceptually, it is possible that some dimensions play a more significant role than others. Therefore, future theoretical investigations are warranted to understand what dimensions of service are important in delivering quality services.

In electronic markets, many types of services are delivered through customer self-service: when a customer tracks her order online, she is, in fact, performing self-service. Prior study has argued that self-service can make customers feel more empowered (Meuter et al. 2000). However, a counter-argument can be made that when a website is not properly designed to deliver smooth self-service, customers can also feel helpless. In what online retailing context is self-service more appropriate? Does self-service work better for retailers selling search products or experience products? How does self-service weigh on customer satisfaction relative to more traditional types of services such as customer support through telephone? We believe that, as online retailers investigate better and cheaper ways to deliver quality service to their customers, the above questions are worthy of further study.

CHAPTER 3

EVOLUTION OF ONLINE PRICING STRATEGIES IN B2C ELECTRONIC MARKETS

Introduction

Recent years have seen tremendous growth in electronic commerce applications, with the total e-commerce sales reaching to approximately $108.7 billion for 2006, an increase of 23.5 percent from 2005 (U.S. Census Bureau 2007). Along with the growth of e-commerce, the number of online fraud reported increases every year. In 2006, 207,492 complaints were filed to the FBI's Internet Crime Complaint Center (IC3). IC3 referred 86,279 crime complaints to federal, state, and local law enforcement agencies for further investigation. The total dollar loss from all referred cases of fraud was $198.44 million with a median dollar loss of $724.00 per complaint. This is up from $183.12 million in total reported losses in 2005 (IC3 Report 2006). Price dispersion rather than the rule of same price is commonly found in electronic markets for mass produced physical goods, varying from a low of 15 for desktop computers to a high of 73 for books measured as percentage price difference (e.g. Clay et al. 2001, Clemons et al. 2002, Pan et al. 2004, Smith and Brynjolfsson 2001). The Internet seems to not provide the gains in information efficiency that many have predicted (Malone et al. 1987; Benjamin and Wigand 1995).

It has been argued that price dispersion may be a disequilibrium phenomenon that reflects the random noise of an immature market (Brynjolfsson and Smith 2000). In contrast, another stream of literature suggests that price dispersion could be an equilibrium phenomenon. For instance, Varian (1980) presents a static model where

oligopolistic sellers use mixed strategies in price. If the game replicated independently over time, the mixed strategies produced price variation over time. Salop and Stiglitz (1977) show that, if consumers have different costs of obtaining information, firms charge informed and uninformed consumers different prices. Baye and Morgan (2001) present a model of equilibrium price dispersion in the Internet. They examine the equilibrium interaction between the price information market and the homogenous product market it serves. Their model suggests the existence of equilibrium where the product market exhibits price dispersion. Recent longitudinal analyses on price dispersion suggest that online price dispersion is a persistent phenomenon and the maturity of electronic markets has not yielded a frictionless market. For example, Baylis and Perloff (2002) found that the shape of the price distribution by week and the range or standard deviation of prices remained relatively constant throughout an 11 to 14 week sample period. Ratchford et al. (2003) compare levels of price dispersion for over 500 product item in November 2000, November 2001, and February 2003, and find that the magnitude of price dispersion continues to be substantial. Baye et al. (2004) examine four million daily price observations for consumer electronics products listed at Shopper.com from August 2000 to March 2001. The three measures of price dispersion in their paper were found to be quite stable over the sample period.

A common explanation of price dispersion on the Internet is that firms offering high service levels charge premium prices (Varian 2000). Another explanation says that price dispersion may reflect discrimination against ignorant consumers (Salop and Stiglitz 1977). Although the magnitude of price dispersion remains quite stable, the driving factors of price dispersion may not remain stable. It is of great interest to

understand whether and how these driving factors evolve over time. In this essay, we utilize data collected online in November 2001 and May 2006 to investigate the changes of online pricing strategies over time. More specifically, we examine how an e-retailer utilizes service quality, store characteristics, and obfuscation practices to charge price premium. Online book retailers generally engaged in obfuscation practice and took advantage of asymmetric information regarding shipping options. Retailers with longer delivery time charged higher unit prices in 2001, as documented in extant literature. The relationship between shipping time and price changed to negative in 2006, as a consumer model with perfect information would predict. In 2001, trust assurance seals had no significant impact on price levels, however, over the period from 2001-2006 more American consumers have become security conscious, and as a result the effect of seals on price has materialized. In 2006, stores with seals, *ceteris paribus*, can charge a price that is approximately 7% higher. Evaluated at the mean of $24.46, this amounts to a $1.7 price premium due to the presence of trust assurance seals, which is only a conservative estimate of the impact of online security and privacy protection. Therefore, it is not surprising to see that more and more stores displayed trust assurance seals on their websites, with the percentage of stores with seals jumping from 22% in 2001 to 59% in 2006. Retailers with dual-channels can charge higher prices now than they could in 2001, mostly because of better channel integration.

The essay is organized as follows. Section 2 presents the conceptual model for our analyses and formulates five testable hypotheses. In Section 3, we describe the data and our collection methodology. Section 4 discusses the empirical results and managerial implications. Section 5 concludes.

Conceptual Model and Hypotheses

A rational consumer with enough information generally would not choose an online retailer with a higher price yet bad service quality. Varian (2000) predicts that over time two groups of e-retailers would emerge: one providing little service at a low price and the other one offering good service at a high price. However, Baylis and Perloff (2002) show that Internet retail markets for digital cameras and scanners consist of *good* firms with low prices and superior service and *bad* firms that charge high prices and offer poor service. They attribute the phenomenon to firms' discrimination among consumers with different knowledge, search costs, or patience (Salop and Stiglitz 1977). Ellison and Ellison (2005) argue that Internet retailers have an incentive to engage in obfuscation in a market when facing price search technologies: put some friction back in the market by making price search more difficult and/or less of a threat to profitability. One of the most visible search versus obfuscation battles, according to Ellison and Ellison (2005), was fought over shipping costs and shipping times. Smith and Brynjolfsson (2001) find that consumers are roughly twice as sensitive to shipping fees as to base price when making online purchase decisions.

For the same product, some vendors may offer longer delivery times, while others offer immediate delivery. Shipping fees also differ. When consumers are perfectly informed, a unit change in base price is equivalent to a unit change in shipping fee. Therefore, retailers that charged higher shipping fees would have to charge a lower price so that the total price remained constant. Shipping and handling could be treated as one aspect of retailer service (Pan, et al. 2002, 2003, Baylis and Perloff 2002). Vendors offering high service levels should be able to charge price premium. However, if some

consumers have imperfect information about base prices and shipping fees, and if they learn about shipping options only after spending additional effort and time at a firm's website, manipulating shipping options to retailers' advantage is possible. Retailers with longer shipping times and shipping fees could actually charge higher prices. Tedeschi (2001) reports that CDNow made profit on shipping in the early days of e-commerce by charging customer $3 for the first item and $1 for each additional item, a price that was then far above the average cost of shipping a CD. Baylis and Perloff (2002) find a quadratic relationship between shipping fees and total price, i.e., total price increased with the shipping fee at a diminishing rate. Dinlersoz and Li (2006) find that firms that charge lower base prices tend to offer lower shipping fees and higher shipping quality, as measured by average delivery time. The base price and the shipping fee are positively correlated even after controlling for other differences across firms. Obfuscation with respect to shipping is not sustainable, as more search engines are displaying shipping charges and more consumers are well informed. Therefore we propose that:

Hypothesis 1a: *In early stages of e-commerce, retailers engage in obfuscation practices with respect to shipping, i.e., they charge higher prices for longer shipping times and higher shipping charges.*

Hypothesis 1b: *Obfuscation practices with respect to shipping are not sustainable, and retailers charge higher prices for shorter shipping times and lower shipping charges as the Internet market grows.*

To take advantage of online transactions, consumers need to provide valuable information about themselves, such as name, demographic, and credit card number. It may be impossible to conduct transaction on the Internet without revealing private

information. Firms can also collect information on customer online behavior using cookies and click-through data. Consumers are becoming more concerned about online vendors' trustworthiness. According to Van den Poel and Leunis (1999), consumers perceive that the Internet channel is more risky than the traditional channels. Prior literature (Bhimani 1996; Griffin et al. 1997) also suggests that online shopping risks are amplified by issues like the security and disclosure of information during and after the transaction process. Stewart (2003) suggests that consumers' willingness to buy from an online vendor is a function of both trust in that store and perceived Internet-related risks.

To promote consumers' trust, many business-to-consumer (B2C) online merchants are currently displaying trust assurance seals on their websites. Displaying more seals generally signals a stronger commitment of the retailer to security and privacy policies. The trust assurance seals displayed on the storefronts could alleviate the online risk faced by consumers and provide ways for smaller, less-established stores to attract online shoppers. Such effects should be transferred to pricing behaviors of online vendors and lead to differentiated prices. Consumers may not directly pay out of their pockets for such services, but they may pay indirectly through the premium they pay for goods and services they purchase from these stores (Rust et al. 2002). Stores with seals charge a higher price yet still attract a profitable number of consumers, while stores with no seal have to lower their price in order to allure consumers to buy from their shops.

During the emerging stages of e-commerce, consumers tend to be more affluent and therefore less price sensitive (Degeratu et al. 2000). As the Internet market grows, the dominance of affluent, time-constrained customers who are less price sensitive is likely to be attenuated (Geysktas et al. 2002). Moreover, with the proliferation of viruses,

phishing attacks, and other maliciousness online, more consumers have become security or privacy-conscious. According to an IBM survey (January 25, 2006), more and more Americans anticipate falling victim to a cyber attack than a physical crime. This increased anxiety about the possibility of a cyber attack changes consumer behavior: 70% of Americans now only use Internet shopping sites that display a security protection seal. We hypothesize that:

Hypothesis 2a: *E-retailers that display trust assurance seals on their storefronts charge higher prices than those without seals.*

Hypothesis 2b: *Retailers that display more trust assurance seals can charge higher prices.*

Hypothesis 2c: *The impact of trust assurance seals on price grows stronger over the years.*

A wide selection of products offers consumers the convenience to locate and purchase obscure products. Consumers may be willing to pay price premium for such convenience. Research on product variety has been done intensively, but provides conflicting results. Several papers find that reducing the number of less popular items a store carries within a category results in unchanged or increased category sales (e.g., Drèze et al. 1994; Broniarczyk et al. 1998; Boatwright and Nunes 2001, 2004). In contrast, Borle et al. (2005) find that cutting product assortment may erode consumer retention and reduce overall store sales. Reducing product selection can drive consumers to a rival with a broader product assortment. Brynjolfsson et al. (2003) find that increased product variety significantly enhances consumer welfare. Their study reveals a $0.70 to 1 billion consumer welfare increase that comes from the increased product variety of online

bookstores. If convenience brought by broad product assortment could build consumer retention and loyalty, retailers may charge a price premium. Therefore, we propose the following testable hypothesis:

Hypothesis 3: *Retailers with broader product selections will charge higher prices.*

Multi-channel retailers could charge higher prices than do pure play Internet retailers. This is because they provide better pick-up and return service, more convenient product inspection, and greater consumer trust. Ancarani and Shankar (2004) compared the levels of price of books and CDs between multi-channel and pure Internet retailers. Their results showed that multi-channel retailers had higher average prices than pure Internet retailers, regardless of whether the listed price or total price was considered. Tang and Xing (2001) found that multi-channel retailers had significantly higher prices than pure play e-retailers using a data set containing 4,896 price observations for 51 DVD titles sold at pure play e-retailers and top multi-channel retailers. Pan et al. (2002) also found evidence that multi-channel retailers have higher prices after controlling for retailer characteristics. Therefore,

Hypothesis 4: *Retailers with dual channels will charge higher prices than pure Internet retailers.*

I am now testing the differences of pricing strategies between survivals and exits as well as between incumbents and entrants. The theory and hypotheses are still under development.

The Data

Before we empirically test our model, one issue that must be addressed is product heterogeneity. To control for possible product heterogeneity across stores, we collected

price data from the online book market. One reason we choose the online book market is that books are a simple physical good that can be cheaply shipped to consumers over a large area. The homogeneous nature of books enables us to investigate price dispersion without worrying about difficulties rendered by any product quality differences. Moreover, book publishers charge the same wholesale prices on an individual book across retailers, regardless of the size of the retailer or the channel that the retailer operates (e.g., Clay et al. 2001; Brynjolfsson et al. 2003). Therefore we are able to control for most of the cost factors in our model.

Two-period data was collected in this study. The sample includes two categories of books: bestsellers and a random sample of books in print. In November 2001, we randomly selected 10 books from Yahoo! Shopping. In order to get the most complete list of online bookstores possible, we first used several shopbots such as pricescan.com and pricegrabber.com to search 10 books in order to get a list of online bookstores. Second, we added some bookstores that were not found by the shopbots, but were mentioned by other prior literature or trade magazines. By doing that we compiled a list of all available online bookstores at the data collection time. We found 20 different online bookstores available in 2001. We collected all the prices and shipping and handling fees for the standard shipping option. In May 2006, we randomly selected 106 books. Through the same means we used in 2001, we got a list of 22 different available bookstores. Interestingly, out of the 20 stores in 2001 only 8 survived over the 2001-2006 period.

Unit price is the list price retailers charged for each book, and total price is measured as the list price plus the handling fee and the charge for standard shipping.

Several stores ask different shipping charges for the same book based on location. We collected the standard shipping charges using zip code GA 30075. Only one store, Wal-Mart, charges tax for books shipped to all U.S. states. We excluded tax from the total price because the tax is affected by other factors that cannot be captured in this study. Stores selling only second-hand books were eliminated. Some stores might "bait and switch." They strategically advertise a low price, but do not honor that price. By collecting price data directly from the book stores instead of price search engines, we are able to alleviate the confounding impact of bait and switch.

For each book we also collected data on "Acquisition time," "Shipping time," and "In stock". "Acquisition time" is the time from order placement until shipping, while "Shipping time" is the time from shipment until delivery, measured as average shipping time by a retailer for its standard shipping option. "In stock" notifies consumers of the availability of the book. We calculated the percentage of books that are in stock at a particular store and named the new variable "Product variety." We browsed each bookstore's website and recorded any trust assurance seals that were displayed. In total, there were 4 distinct seals in 2001 and 9 in 2006. One store in 2006, Textbookx.com, displayed 4 seals on its website at the time when the data was collected. In our 2001 sample, about 25% of online retailers had seals, of which about 15% had more than one seal. These numbers increased to 59% and 37% in 2006, respectively. Out of the 8 survivors over 2001-2006, 5 stores have seals where three stores add seals after 2001. A dummy variable named "Seal" was constructed, which equals 1 for the stores with at least one seal and 0 otherwise. We also included the number of seals ("NSeal") to study the impact of having more than one seal on price.

A number of control variables were collected to control for store-specific factors that may influence pricing strategies. We added a dummy variable "Channel" with 0 denoting "pure e-commerce" stores and 1 for "brick-and-click" stores. Another dummy variable, "Public," was included, with 1 for websites owned by public companies and 0 otherwise. We checked each store against the COMPUSTAT database. If the store is listed in the COMPUSTAT database, it is considered as a store owned by a public company. We constructed a dummy, "Brand Name," with 1 equal to brand-name stores and 0 otherwise. Variable description is reported in Table 2.1.

Table 2.1 Description of Variables Used in the Empirical Analysis

Variable	Variable Description
Price	Unit list price of each book charged by retailers ($)
Shipping Charge	Shipping fee charged by a retailer for each book when the standard shipping option is selected ($)
Acquisition Time	The time from placing an order until shipping (in business days)
Shipping Time	Average reported shipping time for the standard shipping option (in business days)
Product Variety	The percentage of books that are in stock (%)
Seal	Dummy variable: 1 for stores with seals, 0 for stores without
NSeal	The number of seals displayed on the store's website
In Stock	Dummy variable: 1 if the book is in stock, 0 otherwise
Channel	Dummy variable: 1 for "brick and click" stores and 0 for pure online stores
Public	Dummy variable: 1 for publicly traded companies and 0 otherwise
Brand Name	Dummy variable: 1 if the store is well-known, 0 otherwise

Empirical Analyses and Results

Table 2.2 provides descriptive statistics of price dispersion for the 2001 and 2006 samples. We measure price dispersion by range, percentage difference, standard deviation, and coefficient of variation. Large variations of prices were found across online book retailers in both 2001 and 2006. For example, price range, measured as the difference between the maximum and minimum unit price of each book, are both significantly different from zero in 2001 and 2006, with the t-statistics being 5.45 and 8.13, respectively. We normalize maximal and minimal price by list price and calculate the percentage difference to control for list price. The results are consistent. Price range and percentage difference only consider the two extreme observations and ignore all other prices. They may not capture the competitive structure of the market. Therefore, we calculate standard deviation and variance to take into consideration every price observation. Both measures indicate substantial price dispersion. Moreover, the price dispersion in 2006 seems grow larger. We use the t-statistics with Satterthwaite's approximation for the degrees of freedom to check the difference between measures in 2001 and in 2006. The price dispersion in 2006 is statistically larger than in 2001. The descriptive statistics suggest that price dispersion is an equilibrium phenomenon.

Table 2.2 Price Dispersion across Online Book Retailers in 2001 and 2006

Price Dispersions	Range	Percentage Difference	Standard Deviation	Coefficient of Variation
2001	11.06***	0.61***	3.23***	0.18***
	(2.03)	(0.04)	(0.61)	(0.01)
2006	17.55***	0.76***	4.76***	0.21***
	(2.16)	(0.03)	(0.52)	(0.01)

Note: *, **, *** = significant at 10%, 5% and 1% level. Standard errors are reported in parentheses.

There is a significant variation in shipping time and shipping charge. Figure 2.1 shows the relationship between shipping time and unit price. We eliminated stores with a small number of books available. As illustrated by the left panel of Figure 2.1, there is a positive relationship between unit price and shipping time for stores which exited over 2001-2006, yet the pattern seems reversed for survivors. The right panel shows that most of the retailers in 2006 exhibited a pattern where lower product price is associated with lower quality shipping and higher price is related to higher quality shipping. Figure 2.1 suggests that online retailers changed their pricing behavior with respect to shipping options. However, this graph does not consider stores lacking sufficient observation. It also fails to account for the confounding effects of other firm characteristics.

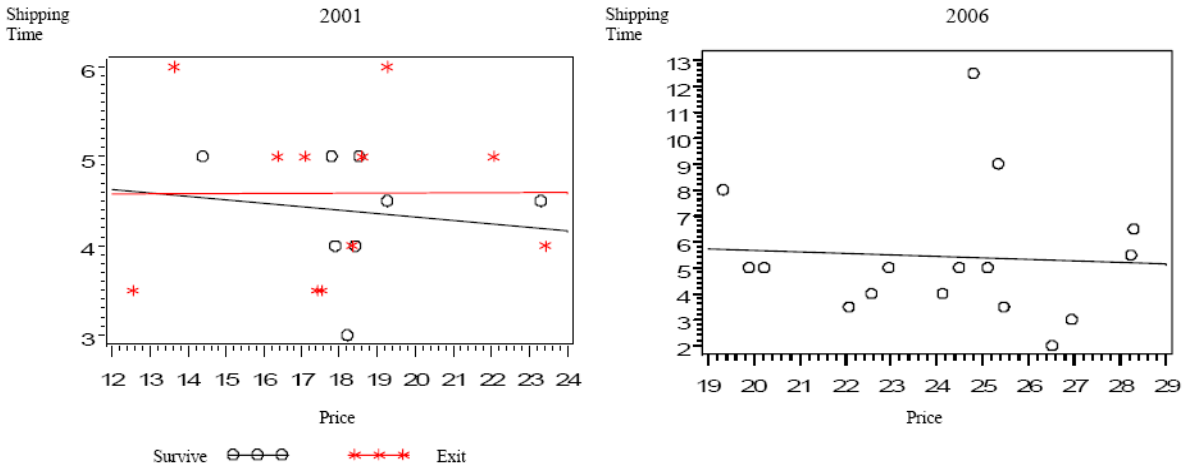


Figure 2.1 The Relationship of Price and Shipping Quality Over Time

To help disentangle these effects, we use a hedonic price function where the unit price (P) charged by store *i* for book *j* is given by

$$\ln(P_{ij}) = \beta_0 + X\beta + \varepsilon_{ij} \qquad (1)$$

where X is the vector of regressors (shipping charges, delivery time, book in stock, firm characteristics, and book dummies). Following Baylis and Perloff (2002), we do not include firm-specific dummies because firm dummies would be perfectly collinear with dummies representing firm characteristics. To address heteroscedasticity and the correlation of errors within books, we run fixed effects models with robust standard errors clustered by book. We run regressions using 2006 and 2001 data separately and compare the results. We focus on retailers' online pricing strategies. Although the number of books varies greatly in 2001 and 2006, what matters in this essay is the number of vendors since. The confounding impact of book heterogeneity is controlled by book dummies. Regression results are reported in Table 2.3.

As shown in Table 2.3, acquisition time has a positive and significant effect on price for 2001 sample. This is in support of Hypothesis 1a. In particular, an additional day of acquisition time increases the price by about 1% in 2001. Shipping time is also significantly positive at the 5% level, with the coefficient ranging from 4% to 5%. It seems that online book retailers with longer delivery times generally charge higher unit prices. From the consumer's point of view, additional waiting time to get the book should be offset by a discounted price. Such a pricing strategy suggested by the empirical results does not seem to favor the consumer, indicating that online retailers engage in obfuscation to avoid the Bertrand paradox. This result is consistent with the finding of "good firms and bad firms" (Baylis and Perloff 2002). Firms with desirable attributes would charge less to attract informed consumers, while firms with undesirable attributes would charge consumers with higher search cost. Dinlersoz and Li (2006) also find that shipping time is positively related with price.

Table 2.3 Estimation Results of Online Price Strategies

Independent Variable	Specifications			
	2006	2001	2006	2001
Seal	0.07***	0.04	-	-
	(0.01)	(0.03)		
NSeal	-	-	0.01**	-0.002
			(0.005)	(0.01)
Acquisition Time	-0.001	0.01**	0.001	0.01***
	(0.001)	(0.003)	(0.001)	(0.004)
Shipping Time	-0.02***	0.05*	-0.01*	0.05*
	(0.01)	(0.02)	(0.006)	(0.02)
Shipping Charge	-0.02**	-0.03	-0.016**	-0.03
	(0.01)	(0.02)	(0.008)	(0.02)
In Stock	-0.14*	-0.20	-0.15***	-0.20***
	(0.03)	(0.06)	(0.03)	(0.06)
Product Variety	-0.00	0.002	0.00	0.002
	(0.0004)	(0.003)	(0.00)	(0.003)
Public	-0.06***	0.11***	-0.07***	0.08**
	(0.01)	(0.04)	(0.02)	(0.03)
Channel	0.15***	-0.008	0.14***	0.004
	(0.01)	(0.05)	(0.01)	(0.05)
Brand Name	0.004	-0.09**	0.004	-0.09**
	(0.02)	(0.04)	(0.02)	(0.04)
No. of Observations	1254	139	1254	139
R^2 (within)	0.14	0.14	0.13	0.13

Note: *, **, *** = significant at 10%, 5% and 1% level. Standard errors are reported in parentheses.

Consumers might not have much information on the availability of information about the quality of book vendors at that time. With the extensive use of search engines and third party ratings, consumers could easily access information on a store's delivery quality, which greatly reduced the opportunism behavior of bookstores. Moreover, the Internet is now attracting more and more people to online shopping. As a result, the demographics of online shoppers have begun to more closely mirror America in general. According to Forrester Research Inc, about 41% of Internet shoppers in the U.S. made their first online purchase within the past four years. Compared with the Web-shopping

pioneers of the late 1990s who were typically young, well-off, and male, these newcomers are less affluent and less tech-savvy. They care more about low prices and are more likely to recognize and trust the store names they know well, such as Gap or Wal-Mart, over online merchants like Amazon or eBay (Vara and Mylene 2006). Every consumer need not have perfect information. If there are enough perfectly informed consumers, the potential search keeps the market competitive. The informed exert a positive pecuniary externality on the uninformed (Salop and Stiglitz 1977). As more consumers became informed on shipping charges, obfuscation with respect to shipping options would be less likely to provide a benefit to retailers. Indeed, the list price no longer responds to an additional day of acquisition, and shipping time now has a negative effect on the price as expected. Specifically, an additional shipping day decreases the list price by an amount ranging from 1% to 2%. Online retailers are now competing to ship items more quickly than rivals and are passing fewer or no costs on to consumers, suggesting a more competitive online book market. These results provide support for Hypothesis 1b. The e-commerce industry has become more efficient.

In support of Hypothesis 2a, online bookstores with seals could generally charge a 7% higher price premium after we controlled for other factors (Column 1 Table 2.3). Evaluated at the mean price of $24.46, consumers are willing to pay a price premium of approximately $1.7 for the presence of seals. We also ran regressions with "*NSeal*" included. The results on the variable *NSeal* are in support of Hypothesis 2b; i.e., websites displaying more seals can generally charge higher prices. Interestingly, the existence of seals does not seem to have significant effects on pricing in 2001. In 2001, online retailers with seals in general did not charge a premium for having seals, even though

purchasing seals cost additional money or efforts. It may be that most consumers did not recognize the value of these online seals, which makes it difficult for stores to charge a premium. The impact of displaying trust assurance seals materialized in 2006 as more consumers became security conscious. The results show strong support for Hypothesis 2c.

We did not find strong evidence in support of Hypothesis 3. As suggested by the results, product variety has no significant influence on the price level charged by online bookstores. Hypothesis 4 is supported by empirical results in the 2006 sample but not in the 2001 sample. In 2006, stores with dual channels were able to charge higher prices; while in 2001 having dual channels did not give stores an advantage to charge price premiums. We attribute this result to better integration of channels in recent years. The results for most control variables are generally consistent with expectations, although some may not always be statistically significant. When the book is in stock, it takes the retailers no effort to acquire and therefore its list price is usually lower. Online bookstores with brand names charge lower prices. It seems that bookstores with brand names try to drive other stores out of business by lowering their price and give up premiums for their name in the short run in order to dominate the market in the long run. In the 2006 sample, the impact of brand names on price is positive, though not significant.

Currently, one dummy "Survival" was constructed, with 1 representing retailers survived up to now and 0 denoting exits. I interact it with all the independent variables and added into the regression model in the 2001 sample. Preliminary results show that big differences in survival and exit pricing behaviors exist in 2001. The with-in R square

increased from 0.13 to 0.60. More specifically, survivals generally charge low for lower service quality, however, exits engaging in obfuscation. To test the difference of pricing strategies between incumbents and new entrants, I add a dummy "incumbent", with 1 representing incumbents. The dummy itself and the interaction terms were included in the model for the 2006 sample. The with-in R Square increased but not as dramatically as in 2001. Living up to our expectations, the pricing strategies of incumbents and new entrants are quite similar, both charge prices according to their service quality. This result also indicates that new entrants followed the success of the survivals and learned lessons from the failures of the exits. Empirical results are available upon request.

Implication and Conclusion

In this essay, we employ data collected online in November 2001 and May 2006 to investigate online price strategies in B2C electronic markets over time. We find evidence in support of the conceptual model. Price dispersion is found to be a persistent phenomenon, but the factors driving price dispersion have evolved over time. Five years ago online book retailers generally engaged in obfuscation practice: some retailers strategically frustrated consumers to search and charge a higher unit price for a longer delivery time. However, in 2006 retailer with longer shipping times can only charge lower prices, consistent with the prediction of models with perfect informed consumers. Online bookstores with trust assurance seals charge higher price in 2006, after controlling for other factors. Our empirical results also show weak support for a hypothesis that websites displaying more seals can charge higher prices. Interestingly, the existence of seals does not seem to have a significant effect on price in 2001. It may be that most

consumers began to recognize the value of these seals. Extension of this analysis to other industries is desirable for robustness and further insight.

CHAPTER 4

IT ASSETS, CROSS-CHANNEL CAPABILITIES, AND MARKET ACTIONS: A LONGITUDINAL STUDY OF THE APPAREL INDUSTRY

Introduction

In the early days of the commercial Internet, online pure-play retailers largely dominated the business to consumer (B2C) e-commerce market. Traditional retailers at that time were reluctant to embrace the new channel. The reluctance of existing retailers to diversify to the Internet market stemmed partly from the potential problems associated with the channel conflict between traditional and Internet retail channels (Dinlersoz and Hernández-Murillo 2005, Weltevreden and Boschma 2008). Over time, many traditional brick-and-mortar retailers have discovered the great potential of the Internet and have added the online channel. However, different channels are typically organized as separate business divisions, each with its own information technology (IT) infrastructure, rules, and processes. When customers want to shop in multiple channels, some retailers have to accommodate the demands through manual processes that are not productive and often leave customers unsatisfied (AMR Research 2006).

Channel integration is clearly the solution and it is becoming an operation standard for the retail industry (Kumar and Venkatesan 2005). The ability to effectively sense, shape, and fulfill customer demand through a customer's channel of choice has become a retailer's new competitive differentiator (Wind and Mahajan 2002). Efficient cross-channel integration is key to customer satisfaction and growth in the retail industry.

Firms without integrated cross-channel retailing could face high costs to satisfy customer demands and lose large revenue opportunities from a growing customer base that value channel integration. According to Forrester Research (2006), about 55% of the U.S. online consumers shop in multiple channels. These customers are usually better educated and have higher purchasing power. They are technologically savvy, and want to be sure that they have the same shopping experience, regardless of the channel. Moreover, channel integration has also become a catalyst for many retail innovations. Together with other complementary organizational resources, a retailer can leverage its IT assets and IT-enabled cross-channel capabilities to introduce new products and services. For example, GAP has launched new product brands specifically for the online channel. In an increasing competitive retail marketplace, products could quickly become obsolete and competitive positions can be rapidly overtaken. Leading retail companies are leveraging their IT and other organizational resources to be more responsive in the competitive marketplace.

Considerable attention has been given to the adoption and utilization of the Internet by e-commerce companies (Gertner and Stillman 2001, Geyskens et al. 2002). Yet, there has been little research on the antecedents and effects of the integration of online and offline channels. This study examines cross-channel capabilities and competitive actions by linking the literature in resource-based view (RBV), IT business value, retail management, and competitive dynamics. Our objective is to study how IT assets allow firms to develop high level capabilities, and how the combined IT assets and firm capabilities affect competitive actions.

We have collected a longitudinal dataset on the apparel industry in the U.S. over the period of 1995 to 2007. Apparel industry provides a particularly insightful case to investigate the above research questions. Because consumers may perceive clothing as products that have to be seen, touched, and tried on before purchase (De Figueiredo 2000), the industry was initially slow to adopt the online channel. Despite the slow take-off, apparel is one of the leading products sold over the Internet today (U.S. Census Bureau 2007). Yet, within the apparel industry, retailers' use of the online channel is highly heterogeneous, ranging from full, partial, to no integration with other channels.

The study makes several contributions to the literature. First, our research is one of the first attempts to empirically study the relationship between IT assets, channel capabilities, and firm competitive actions using a longitudinal dataset. Our results provide insightful implications to managers in the apparel and other retail industries that are looking to leverage the Internet channel to provide better service and create higher customer values. Second, the research contributes to the literature by examining how IT resources create business values. Prior literature in IT business value often use aggregate measures of firm performance as dependent variables. We examine the impact of IT assets via intermediate business process and help to open the box of how IT help create firms' capabilities and affect firms' managerial actions, which could then lead to superior performance. The findings of our study provide actionable guidance to managers who develop strategies and make decisions on how to invest and combine IT and organizational resources. Third, this study investigates the impacts of a firm's IT resources and IT-related capabilities on competitive activities. We find that IT assets are important resources that not only increase the frequency of actions, but also broaden the

types of actions. While market-oriented capabilities such as e-commerce and multi-channel cross-selling capabilities broaden the range of market actions, operation-oriented capabilities such as cross-channel fulfillment could narrow a firm's market action range.

The remainder of the essay is organized as follows: We review prior literature and provide motivations for this study in Section 2. Section 3 develops the theory and testable hypotheses. We describe data and methodology in Section 4. Econometrics results are presented in Section 5. Section 6 discusses our results and concluding remarks are given in Section 7.

Literature and Motivation

This study draws on the literature in IS, strategic management, and retail operation and service management. In this section, we review the relevant studies and provide motivation for this research.

The business value of IT has been a hot-debated area to both practitioners and IS researchers. Prior studies have employed several theoretical paradigms to examine the performance impacts of IT. Microeconomic theories have been extensively used to provide empirical specifications for estimation of the economic impact of IT (Brynjolfsson and Hitt 1996). These studies have investigated the IT value at an aggregate level. Recent studies have started examining the underlying mechanisms by which IT relates to firm performance. One important research stream is the application of RBV in exploring how IT resources change business operations and create values (Wade and Hulland 2004). Powell and Dent-Micallef (1997), for example, found that IT resources had no effect on firm performance unless IT was used to leverage the complementary human and business resources such as flexible culture and supplier

relationships. Bharadwaj (2000) proposed that through combining IT-related resources to create a unique IT capability, firms can obtain superior performance. Santhanam and Hartono (2003) also found that firms with superior IT capability exhibit better firm performance.

From a theoretical perspective, RBV has proven particularly useful in opening up the "black box" on how IT affects firm performance. According to the RBV theory, resources and organizational capabilities are valuable sources of competitive advantage (Barney 1992, Teece et al. 1997, Lado and Wilson 1994). They are likely to be heterogeneously distributed across firms and are rent-yielding when they are valuable, rare, imperfectly imitable, and nonsubstitutable (Barney 1991, Grant 1991). Firms can create competitive advantages through two distinct mechanisms (Makadok 2001). Resource picking mechanism asserts that firms create rents by selecting resources more effectively than their competitors. The capability-building view asserts that firms create competitive advantages by deploying resources more effectively. This study is particularly related to the latter mechanism and aims to examine how firms utilize IT resources to develop cross-channel capabilities.

Most empirical work of RBV, in both strategic management and IS literature, uses overall firm performance as the dependent variable. However, simply examining the relationship between a firm's resources and its overall performance could lead to misleading conclusions with respect to RBV (Ray et al. 2004). One reason is that firms can have competitive advantages in some business activities and disadvantages in others. Using a highly aggregated dependent variable such as firm performance may neglect the underlying mechanism of how IT is combined with other organizational resources to

change business processes and competitive tactics. Several studies in strategic management have addressed this problem by examining the implications of RBV on a firm's product development ability (Henderson and Cockburn 1994), manufacturing effectiveness (Schroeder et al. 2002), and customer service (Ray et al. 2004).

In this study, we use cross-channel capabilities and competitive actions as dependent variables and examine how IT assets affect these dimensions. Cross-channel capabilities and competitive actions are two key strategic aspects for apparel companies.

First, apparel as well as other retailers is clearly moving toward multiple channels, creating a proliferation of channels through which customers can interact with the retailers (Neslin et al. 2006). Customers now can search information via online channels, place orders, and pick up products through bricks-and-mortar stores. They can also place orders in stores using kiosks when the desired products are out of stock. This proliferation has presented challenges for firms to manage multiple channels effectively. Now, the ability to effectively integrate channels and manage marketing communications with customers has become a new differentiator that is critical to increase customer satisfaction and future growth (Wind and Mahajan 2002, Thomas and Sullivan 2005). Instead of cannibalizing the physical channel, companies could make multiple channels to complement each other (Deleersnyder et al. 2002). Multichannel customers usually buy more often and spend more, compared with single-channel shoppers (Kumar and Venkatesan 2005, Kushwaha and Shankar 2005). Multiple channels could also allow retailers to improve customer retention and attract new customers (Venkatesan et al. 2007). However, there is a lack of study on antecedents of channel integration capabilities in the existent literature. This study draws on the theories of RBV,

competitive dynamics, and IT business value, to examine the factors that lead to cross-channel capabilities.

Second, we posit that integrated cross-channel capabilities, combined with firms' IT assets, affect firm actions in the competitive marketplace. In a highly competitive sector, such as the apparel industry, firms must undertake frequent competitive activities over time to create and recreate competitive advantage (D'Aveni 1994). Schumpeter (1934) developed the concept of "creative destruction" to explain the dynamic market process by which firms act and react in the pursuit of market opportunity. IT has certainly intensified competitions in the many industries, allowing firms to reconfigure strategic resources and execute market actions more effectively. Studies in competitive dynamics find that firms that carry out a greater number of total actions and more heterogeneous and complex repertoires of competitive actions experience higher profitability, gain market shares, and are less likely to be dethroned by challengers (Young et al. 1996, Ferrier et al. 1999). Despite the strong evidence of the effects of competitive actions on firm performance, there are only a handful studies on IT-enabled firm actions. Chi et al. (2007, 2008) studied the effects of interorganizational systems (IOS) and partnership network structure on competitive actions, and found systematic associations between network structure and competitive actions, and between IOS and competitive actions. The Internet and online channel have clearly redefined the competitive landscape for the retail industry. Thus, another goal of this study is to extend the prior literature in this area and examine the effects of IT assets and IT-enabled channel capabilities on firm actions in the apparel industry.

Theory and Hypotheses

Defining IT Assets and Cross-Channel Capabilities

From the RBV perspective, resources are stocks of available factors that are owned or controlled by a firm (Barney 1992, Amit and Schoemaker 1993). Resources include various tangible and intangible assets, such as patents, financial or physical assets, that can improve the efficiency and effectiveness of a firm (Barney 1991). IT assets, when narrowly defined, are specific IT-related organizational resources, which include hardware, software systems, and related human capital (Bharadwaj 2000). Broadly speaking, IT assets encompass IT-related organizational processes such as supply chain management and customer relationship management (CRM) (Bresnahan et al. 2002). Since we study those IT-related organizational processes as a part of firm capabilities, the term, IT assets, in this study follows the narrow definition and only refer to software and hardware systems.

There has been an increasing interest within RBV on the importance of organizational capabilities (Barney 1992, Collis 1994, Ray et al. 2004). In contrast to resources, organizational capabilities are "a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end" (Amit and Schoemaker 1993). Capabilities represent a higher productivity of the related organizational resources to create values for the customers and company. According to Stalk et al. (1992), firms need to transform their key business processes into strategic capabilities in order to meet customer needs. An example is Wal-Mart's superior inventory-replenishment capability.

Cross-channel integration allows retailers to interact with their customers more effectively. We define cross-channel capabilities as the ability to sense and tailor a company's offering to satisfy customer demands through whichever channels customers prefer. Cross-channel capabilities are much more than the sum of individual IT systems and related organizational resources. Rather, cross-channel integration, as high-order capabilities, requires the streamline of data, applications, and business processes to enhance customer service, increase sales, foster brand loyalty of the customers, and effectively manage customer lifetime value. (Venkatesan et al. 2007).

The Effects of IT Assets on Channel Integration

One of the purposes of this research is to examine how cross-channel capabilities are created. To develop capabilities, companies first have to make strategic investments in supporting infrastructure that links together and transcends traditional business units and functions (Stalk et al. 1992). Clearly, companies have to invest in IT systems in order to develop cross-channel capabilities. Researchers argue that capabilities are usually information-based (Itami 1987) and involve developing, carrying, and exchanging information through different functional groups and employees (Amit and Schoemaker 1993). Cross-channel capabilities are no exception; they rely on IT and require seamless information sharing between physical and online stores. IT systems enable and automate online purchase and order fulfillment process, which is the foundation of cross channel operations. Moreover, retailers rely on IT systems to design and transform business processes, such as cross-channel order fulfillment and customer relationship management. In order to provide consistent experience across channels, retailers need to integrate their data and create a single order repository for all customers so that they can

get a holistic view of their customers. Further, IT enables retailers to selectively market to customer segments, observe customer responses, and refine future marketing efforts. Thus, we have the following hypothesis:

Hypothesis 1: *IT assets are positively related to cross-channel capabilities.*

According to the RBV theory, the strategic value of one organizational resource is linked to the presence of other organizational resources (Stieglitz and Heine 2007). Two organizational assets are complementary to each other if an increase in one asset enhances the return from the other (Milgrom and Roberts 1990). Powell and Dent-Micallef (1997) found that IT investments require the existence of complementary resources to confer competitive advantage. Melville et al. (2004) proposed an IT business value model where IT resources, along with complementary organizational resources, impact organizational performance via intermediate business process. Developing organizational capabilities, such as cross-channel fulfillment, is costly and requires substantial investment in the IT system. The extent to which a firm can implement sophisticated channel integration could be limited by its financial resources. Scarcity in financial resources can reduce the marginal impacts of IT assets since deploying IT systems requires related investment in redesigns of organizational processes and training of employees (Bresnahan et al. 2002). On the other hand, abundant financial resources allow companies to invest in complementary human and organizational resources. Thus, financial resources should have a positive moderating effect on the relationship between IT and cross-channel capabilities. Therefore, we have the following hypothesis:

Hypothesis 2: *The relationship between IT investment and cross-channel capabilities is positively moderated by the level of a firm's financial resources.*

Cross-channel integration requires tight integration among various customer data, supporting technologies, and business processes (Neslin et al. 2006). For example, cross-channel fulfillment requires coordination among a firm's many functional departments, including procurement, logistic, distribution, inventory management, and sales. Chi et al. (2008) demonstrated that the range of interorganizational systems (IOS), defined as the total number of technological functionalities and services provided by IOS, can enable greater flexibility in devising competitive activities. Likewise, a firm that invests in a narrow range of technologies can only accumulate a relatively simple resource base that may support some functional areas, but not others. Balanced investments among different IT assets can lead to synergies among different IT assets, which, in turn, can increase retailers' channel integration capabilities. Therefore, we hypothesize that:

> Hypothesis 3: *A balanced IT-asset portfolio is positively related to cross-channel capabilities.*

IT-Enabled Competitive Actions

In a highly competitive environment, no firm is safe from the market process of competition (Schumpeter 1934). To create competitive advantage, firms must aggressively carry out frequent competitive activities and find new ways to satisfy customers (D'Aveni 1994). Such actions are defined as externally directed, specific, and observable competitive moves undertaken by a firm to enhance its competitive position (Smith et al 2001). The critical dimensions of competitive actions include: (i) volume, the frequency of actions carried out by firms over a finite time period, (ii) complexity, which refers to how wide-ranging a firm's actions are within some time frame, and (iii) heterogeneity, the tendency of a firm's action repertoire to depart from industry norms.

Much of the competitive dynamics research suggests that firms, which carry out a greater number of total actions and more complex and heterogeneous repertoires of competitive actions over a given time period, have better results (Young et al. 1996, Ferrier et al. 1999).

One important element of competitive dynamics research has focused on how characteristics of the company affect the actions the firm takes (Chen 1996, Smith et al 2001). IT assets provide the resources upon which firm could carry out market actions. Deployment of business intelligence systems, for example, allows the firm to access and analyze market and customer data, understand competitive challenges and opportunities, and increase the firm's awareness of the marketplace. Also, firms with superior IT resources have the ability and flexibility to effectively launch more frequent, more nonconforming, and a broader set of actions. For instance, CRM systems and online stores allow firms to deliver more targeted and effective marketing campaigns. Further, firms with IT resources could process information more efficiently and take quicker actions. Therefore, we have the following hypothesis:

Hypothesis 4: *IT assets are positively related to total number of competitive actions, action repertoire complexity, and action heterogeneity.*

Cross-channel integration capabilities could also facilitate strategic actions. The Internet channel provides a new venue for competitive action. Gap Inc, for example, offered a new product line for online channel exclusively (Grant 2000). Syms Corp. made a bid to extend its customer audience into a younger demographic with the debut of Syms Dress for Success Online (PR Newswire 2002). In addition, cross-channel integration could increase a firm's ability to carry out more frequent, complex, and unpredictable

actions. For example, depending on competitive strategies or operational factors, retailers could promote products in multiple channels, or just the online or physical channel. Thus, we hypothesize:

Hypothesis 5: *Cross-channel capabilities are positively related to total number of competitive actions, action repertoire complexity, and action heterogeneity.*

Research Method

Data

We have collected a longitudinal dataset for publicly-traded apparel retail companies in the U.S. The longitudinal sample enables us to study the changes within companies across different years and eliminate unobservable firm heterogeneity. Our sample is limited to the public firms due to the lack of financial information for private firms. We use the North American Industry Classification System (NAICS) codes to identify companies in the apparel retail industry from the COMPUSTAT database. This resultant list was then confirmed through the EDGAR database from the Securities and Exchange Commission (SEC), Hoover's Company Records, and apparelsearch.com, which is a web site that maintains a directory for apparel retailers. Companies that became inactive before 2000 were dropped from our sample. As a result, our dataset contains over 10 years' data for 49 publicly-traded apparel companies.

The data for this study come from three sources: (i) events data from news media and company web sites, (ii) company interviews, and (iii) data from COMPUSTAT. We conducted interviews and collected data from public records on IT investment and channel integration for each company. Using structured content analysis (Young et al.

1996, Ferrier et al. 1999, Basdeo et al. 2006), we captured managerial actions on the basis of keywords appearing in the text of news reports. By searching the *Lexis-Nexis* database using the keywords in combination with firm name, we were able to identify and collect articles containing possible actions. We tested the reliability of our coding process using Perreault and Leigh's (1989) index of reliability. Although Perreault and Leigh (1989) did not provide specific guidelines as to what value the index should be considered acceptable, they suggested that 0.70 may be a reasonable value. Two academic experts independently coded the sample of actions into each competitive action category. This approach yielded an index value of 0.90, indicating that the coding process for these questions was considered reliable. Financial data for each company were collected from Standard & Poor's COMPUSTAT data. Financial data for 2008 fiscal year were obtained from each company's annual report and 10-k filings to the SEC.

Variables

IT Assets. IT assets are measured as the total number of major initiatives and projects on IT investment in a firm over the period of 1995-2007. The IT initiatives and projects are considered major if these projects are covered in the company's news release or reported in the news media. This includes the installation of major IT systems, supply chain management systems, CRM systems, or data mining tools. This approach is similar to that adopted by Powell and Dent-Micallef (1997), who measured IT intensiveness in terms of number of specific hardware and software systems installed.

We further measured IT assets by three dimensions: (i) IT infrastructure, (ii) enterprise systems, and (iii) CRM and business analytics. We measure *IT infrastructure* by major initiatives on IT investments in Point of Sale (POS) systems, networking, and

web infrastructure. *Enterprise systems* represent the investments in ERP systems, supply chain management systems, and cross-channel order management systems. *CRM and Business analytics* is measured as major initiatives and projects on data mining, business intelligence, and CRM systems. Our classification of IT assets is consistent with the approach used in Melville et al. (2004), which defines IT as hardware and software systems and specific business applications that utilize the infrastructure. We further classify business applications into two categories based on their positions in the value chain: (i) enterprise systems, and (ii) CRM and business analytics. The former focuses on business operation, and the latter focuses on managing customers (Rigby et al. 2002).

Balance of IT-Asset Portfolio. Some firms may intentionally or unintentionally concentrate invest in a narrow range of IT technologies. For example, they may invest more on IT infrastructure, yet neglect enterprise systems or CRM and business analytics. We define IT-asset portfolio as the range of IT assets a firm has invested during the study period. We calculate a firm's propensity to balance its IT investments using a measure adapted from the Herfindahl index:

$$1 - \sum_i (I_i / TI)^2$$

where I_i / TI is the share of a specific IT initiative in the *i*th dimension of the total IT assets and $\sum_i (I_i / TI)^2$ is the Herfindahl Index, which has been widely used to measure the concentration level (Kwoka 1985). The Herfindahl index increases in the concentration level of a specific IT asset among the total assets. Thus, opposite to Herfindahl index, a higher score of our measure on IT-portfolio indicates a more balanced IT-asset portfolio.

Cross-Channel Capabilities. Cross-channel capabilities represent a firm's capability to carry out commerce, fulfillment, and customer service across multiple channels. Following the approach of Gold et al. (2001) that defines knowledge management capabilities, we develop a measurement scale for cross-channel capabilities. We code binary responses to indicate whether a retailer has abilities in the following functional areas (Goersch 2002, Bendoly et al. 2005):

- The retailer has a website to provide company and product information.
- The retailer has an online store that conducts transactions.
- Customers can order online and return in physical stores.
- The retailer has in-store kiosks or other systems that allow online ordering and searching.
- The retailer allows online order and in-store pick up.
- The retailer does price coordination among channels
- The retailer conducts joint-channel promotions

The measure of cross-channel capabilities is calculated as the sum of the values of the binary responses.

A retailer's cross-channel capabilities largely depend on the coordination of different business units that are involved (Bendoly et al. 2005). A smooth operation cross different channels requires different departments such as IT, product, marketing, sales, and logistics to work together. We further measure a retailer's cross-channel capabilities in the following three dimensions: (i) *e-commerce capabilities*, which measure a retailer's ability to provide functional websites and online transactions; (ii) *cross-channel fulfillment capabilities*, which are the firm's capacities to fulfill customer orders through

a customer's channel of choice, e.g. the option to order online and pick up in physical stores; and (iii) *multichannel cross-selling capabilities*, which are the abilities to effectively manage customers across channel. For example, retailers could conduct promotions through a specific channel or multiple channels depending on customer types and inventory levels. The goal is to increase customer loyalty and share of pocket (Meyer-Waarden 2007). In addition, store employees should have the ability to see order history of customers and add an online order to a store purchase.

Our classification of a retailer's cross-channel capabilities is based on a standard functional classification of the firm's activities (Amit and Schoemaker 1993). In addition, the three dimensions of cross-channel capabilities are consistent with the typology of Day (1994) in that e-commerce capabilities are deployed from the inside and activated by market requirements and multichannel cross-selling capabilities leverage outside, durable relationship with customers, while cross-channel fulfillment capabilities provide a crucial link between the above two capabilities.

Competitive Actions. *Action volume* is operationalized as the total number of new competitive moves a firm carried out in a given year, regardless of type (Ferrier et al. 1999). We collected events for the following categories: market penetration, marketing campaign, alliance, promotion, and product introduction. *Complexity of action repertoire* measures competitive action diversity within a firm, that is, the extent to which the aforementioned possible types of action events are represented by firms' activities. Following Ferrier et al. (1999) and Basdeo et al. (2006), we calculated it using a measure adapted from the Herfindahl index:

$$1 - \sum_{j} (N_j / TN)^2$$

where $\sum_j (N_j / TN)^2$ is the Herfindahl index and N_j / TN is the share of competitive actions in the *j*th category. Firms with high scores carry out a more complex action repertoire that gears toward broader action types. Heterogeneous actions are types of actions that are rarely being used by competitors. *Action heterogeneity* refers to the tendency to depart from the norms of industry (Miller and Chen 1994) and it was operationalized as the Euclidean distance of firm *i*'s actions from the industry norm of each action category (Chi et al. 2007, 2008):

$$\sqrt{\sum\nolimits_j^J (x_{ij} - \bar{x}_j)^2 \Big/ J}$$

where $\bar{x}_j = \frac{1}{49}\sum_{i=1}^{49} x_{ij}$, $i = 1, \ldots, 49$. A higher score in this measure indicates greater dissimilarity in the actions of the firm with industry norm.

Financial Resources. Greater slack financial resources could complement IT assets in enhancing channel integration capabilities. More financial resources also allow firms to implement a greater number of competitive moves (Young et al. 1996). The financial resources variable represents organizational slack resources, measured as the ratio of current assets less inventory to current liabilities (Smith et al. 1992, Ferrier 2001).

Firm Size. Firm size is an important determinant of innovation, technology use, and firm performance (Bharadwaj et al. 1999, Rai et al. 2006, Rogers 1995). Moreover, prior literature has suggested that large firms are slower in terms of action timing (Chen and Hambrick 1995) and have simpler competitive repertoires than small firms (Miller and Chen 1996). We use total assets as a measure of firm size to control for the aforementioned effects (Berger and Ofek 1995).

The definitions of the above variables are shown in Table 3.1. The descriptive statistics and the correlation matrix of the variables are reported in Table 3.2.

Table 3.1 Definitions of Variables

Variable	Definition
IT Assets	The total number of major IT initiatives and projects in a firm over the period of 1995-2007.
IT Infrastructure	The total number of major initiatives and projects in POS, networking, and Web infrastructure.
Enterprise Systems	The total number of major initiatives and projects in ERP systems, supply chain management systems, and cross-channel order management systems.
CRM and Business Analytics	The total number of major initiatives and projects in data mining, business intelligence, and CRM systems.
Balance of IT-Asset Portfolio	The range of IT assets a firm has invested over the period of 1995-2007, calculated using HHI across different IT assets components.
Channel Integration Capabilities	Capacity to carry out commerce, fulfillment, and customer service across multiple channels, calculated as the sum of the functional areas.
E-commerce Capabilities	A retailer's abilities to provide functional websites and online transactions.
Cross-channel Fulfillment Capabilities	A retailer's abilities to fulfill customer orders through a customer's channel of choice.
Multichannel Cross-Selling Capabilities	A retailer's abilities to effectively manage customers across channels.
Actions Volume	Total number of new competitive moves undertaken by a firm in a given year, regardless action types.
Complexity of Action Repertoire	The extent to which the two possible types of action events are represented by firms' activities in a given year, measured using HHI across different action categories.
Action Heterogeneity	A firm's tendency to carry out actions that depart from the norms of industry, calculated as the Euclidean distance from the industry norms of each action category in a given year.
Financial Resources	Slack organizational finance resources, measured as the ratio of current assets less inventory to current liabilities.
Firm Size	A variable that represents the size of firms, measured as a firm's total assets (in billions) in a given year.

Table 3.2 Descriptive Statistics and Correlations

Constructs	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. IT Assets	2.12	3.19													
2. Balance of IT-Asset Portfolio	0.27	0.26	0.63												
3. IT infrastructure	0.60	1.08	0.59	0.46											
4. Enterprise Systems	1.12	2.03	0.89	0.44	0.32										
5. CRM and Business Analytics	0.40	0.84	0.59	0.53	0.08	0.34									
6. Cross-Channel Capabilities	1.91	2.08	0.64	0.68	0.48	0.50	0.42								
7. E-commerce Capabilities	1.25	0.85	0.41	0.63	0.39	0.29	0.24	0.83							
8. Cross-channel Fulfillment Capabilities	0.39	0.69	0.65	0.56	0.29	0.59	0.44	0.88	0.65						
9. Multichannel Cross-Selling Capabilities	0.46	0.81	0.57	0.61	0.54	0.38	0.38	0.90	0.63	0.65					
10. Actions Volume	0.57	1.11	0.23	0.24	0.41	0.15	-0.02	0.10	0.19	0.03	0.08				
11. Complexity of Action Repertoire	0.09	0.18	0.25	0.17	0.29	0.15	0.14	0.20	0.10	0.17	0.22	0.54			
12. Action Heterogeneity	0.47	0.52	0.15	0.20	0.34	0.08	-0.07	0.01	0.15	-0.05	-0.02	0.95	0.32		
13. Financial Resources	1.25	1.07	0.05	-0.16	0.13	0.03	-0.04	0.09	0.05	0.11	0.07	-0.01	0.02	-0.07	
14. Firm Size	0.83	1.53	0.53	0.08	0.37	0.66	-0.10	0.27	0.14	0.31	0.23	0.17	0.22	0.09	0.16

Estimation Models

In our study, we have three parts of estimation in order to understand the relationship between IT assets, cross-channel capabilities, and competitive actions. First, we examine factors affecting the overall cross-channel capabilities. To test Hypotheses 1, 2, and 3, we use cross-channel capabilities as the dependent variable. We use a two-way error component panel regression model (Greene 2002). The following is the econometric model:

$$CA_{it} = \mathbf{x}_{it}^{'}\boldsymbol{\beta} + \alpha_i + \gamma_t + \varepsilon_{it}, \quad (1)$$

where CA_{it} is retail *i*'s cross-channel capabilities in year *t*; $\mathbf{x}_{it}^{'}$ is a vector of independent variables including IT assets, balance of IT-asset portfolio, financial resources, the interaction term between IT assets and financial resources, and firm size. The last three terms are two-way error components disturbances. α_i denotes the unobservable firm-specific effect, which is time invariant. It accounts for factors that vary across firms but are relatively stable over time within firms, such as organizational culture. γ_t denotes the unobservable time effect. It is individual-invariant and it controls for any time specific effect that is not included in the regressors, such as macroeconomic or industry demand conditions. ε_{it} denotes the remainder stochastic disturbance term. If the α_i and γ_t are assumed to be fixed parameters to be estimated and ε_{it} the remainder disturbances stochastic with zero mean and constant variance, Equation (1) represents a two-way fixed effects model. If the three terms are independent of each other, then this is the two-way random effects model.

Second, we disaggregate cross-channel capabilities into three dimensions and investigate factors influencing the three dimensions. The following are the econometrics models:

$$EC_{it} = \mathbf{x}_{it}^{'}\boldsymbol{\beta}_1 + \alpha_{1i} + \gamma_{1t} + \varepsilon_{1it} \quad (2)$$

$$FF_{it} = \mathbf{x}_{it}^{'}\boldsymbol{\beta}_2 + \alpha_{2i} + \gamma_{2t} + \varepsilon_{2it} \quad (3)$$

$$CS_{it} = \mathbf{x}_{it}^{'}\boldsymbol{\beta}_3 + \alpha_{3i} + \gamma_{3t} + \varepsilon_{3it} \quad (4)$$

where EC_{it}, FF_{it}, and CS_{it} are e-commerce capabilities, fulfillment capabilities, and cross-selling capabilities, respectively. $\mathbf{x}_{it}^{'}$ is a vector and includes regressors such as IT infrastructure, enterprise systems, CRM and business analytics, financial resources, and firm size. α_{ji} and γ_{jt} denote the unobservable individual-specific effect and the unobservable time effect for equation j (j = 1, 2, 3). ε_{jit} denotes the stochastic disturbance term. We use seemingly unrelated regression (SUR) to estimate the above system of equations. Here we have a system of regression equations whose random errors can be correlated. In this case, the large-sample efficiency of the estimation can be improved by using a joint generalized least-squares method that takes the cross-equation correlations into account (Greene 2002).

Third, we use the following models to examine the factors that affect market actions:

$$AV_{it} = \mathbf{x}_{it}^{'}\boldsymbol{\beta}_4 + \alpha_{4i} + \gamma_{4t} + \varepsilon_{4it} \quad (5)$$

$$AC_{it} = \mathbf{x}_{it}^{'}\boldsymbol{\beta}_5 + \alpha_{5i} + \gamma_{5t} + \varepsilon_{5it} \quad (6)$$

$$AH_{it} = \mathbf{x}_{it}^{'}\boldsymbol{\beta}_6 + \alpha_{6i} + \gamma_{6t} + \varepsilon_{6it} \quad (7)$$

where AV_{it}, AC_{it}, and AH_{it} are action volume, complexity of action repertoire, and action heterogeneity, respectively. $\mathbf{x}_{it}^{'}$ includes IT assets, e-commerce capabilities, cross-

channel fulfillment capabilities, and multichannel cross-selling capabilities, financial resources, and firm size. Again, we use SUR to estimate the above system of equations.

Results

We conducted the Breusch-Pagan tests and the results suggest that there is strong evidence of the retailer-specific effects in our dataset. The F-statistics, testing the joint significance of time effects also suggest the presence of such effects. Therefore, it supports our specifications that include both the firm and time effects. The Hausman test indicates that the retailer-specific effects are correlated with the explanatory variables, suggesting that the fixed effects model is preferred to random-effects estimation (Greene 2002). We, therefore, estimate the econometric models using fixed effects. Panel models with fixed effects and are proven to be particularly useful in eliminating omitted-variable bias such as unobserved firm heterogeneity (Hsiao 1986).

Table 3.3 shows the results of Equation (1). The effect of IT assets on cross-channel capabilities is positive and significant ($p < .01$), supporting Hypothesis 1. The interaction effect of IT assets and financial resources is also positive and significant ($p < .01$). The estimation results also indicate that balance of IT-asset portfolio has a positive and significant effect on cross-channel capabilities ($p < .05$). Therefore, both Hypotheses 2 and 3 are supported.

Our estimation models have some additional findings. It is interesting to note that firm size has a negative effect on cross-channel capabilities. This result is consistent with prior literature that larger firms are usually slower in developing new capabilities (Chen and Hambrick 1995).

It is of practical interest to examine the roles of the various components of IT assets in affecting cross-channel capabilities. We estimated the model and the results suggest that IT infrastructure has the highest marginal impact on cross-channel capabilities ($p < .01$), followed by CRM and business analytics ($p < .01$), and enterprise systems ($p < .1$).

Table 3.3 Factors Affecting Cross-Channel Capabilities

Dependent variable: Cross-Channel Capabilities	Model 1	Model 2	Model 3
Constant	-0.05 (0.19)	2.36*** (0.81)	-0.06 (0.18)
IT Assets	0.31*** (0.03)	0.12** (0.06)	--
IT Infrastructure	--	--	0.76*** (0.08)
Enterprise Systems	--	--	0.09* (0.05)
CRM and Business Analytics	--	--	0.46*** (0.11)
Financial Resources	0.24*** (0.09)	-0.15 (0.20)	0.21** (0.09)
IT Assets * Financial Resources	--	0.13*** (0.05)	--
Balance of IT-Asset Portfolio	--	1.11** (0.50)	--
Firm Size	-0.32*** (0.10)	-0.35* (0.19)	-0.18* (0.10)
R2	0.57	0.36	0.65

Notes: * p<0.1, ** p<0.05, *** p<0.01. Standard errors are reported in parentheses. N=453 for Models 1 and 3; N=222 for Model 2 because of missing observations.

The estimations of Equations (2), (3), and (4) suggest that IT infrastructure has a positive and significant effect ($p< .01$) on e-commerce capabilities, while the effects of enterprise systems as well as CRM and business analytics are not significant. The results are consistent with our expectation since the e-commerce capabilities mainly requires the

support of IT infrastructure. On the other hand, the three components of the IT assets all have highly significant effects on cross-channel fulfillment capabilities ($p<0.01$). As for the capability of multichannel cross-selling, both IT infrastructure and CRM/business analytics have significant impacts ($p<0.01$), but not enterprise systems.

Table 3.4 Factors Affecting Specific Dimensions of Cross-Channel Capabilities

Dependent variables:	E-commerce	Cross-Channel Fulfillment	Multichannel Cross-Selling
Constant	0.84 (0.27)	0.21 (0.24)	0.48* (0.28)
IT Infrastructure	0.17*** (0.03)	0.19*** (0.03)	0.39*** (0.03)
Enterprise Systems	-0.01 (0.02)	0.08*** (0.02)	0.02 (0.02)
CRM and Business Analytics	0.05 (0.04)	0.23*** (0.04)	0.19*** (0.04)
Financial Resources	0.06* (0.04)	0.06* (0.03)	0.09** (0.04)
Firm Size	-0.06 (0.04)	-0.03 (0.04)	-0.09** (0.04)
R2	0.78	0.73	0.75

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Standard errors are reported in parentheses. N=453 for Models 1-3.

Table 3.5 reports the estimation results on factors affecting firm actions. As the results suggest, IT assets are positively related to the total number of actions taken by firms in a given year ($p < .01$). IT assets also have positive and significant impacts on complexity of actions repertoire ($p < .1$) and action heterogeneity ($p < .01$). Therefore, Hypothesis 4 is supported.

However, we did not find significant impacts of cross-channel capabilities on the number of actions. As for action complexity, cross-channel fulfillment capabilities have a

negative impact ($p<0.05$) while the effect of multichannel cross-selling ability is positive ($p<0.01$). We also find that the effect of e-commerce on action heterogeneity is positive ($p<0.01$). However, the effects from cross-channel fulfillment and cross-selling are not significant on action heterogeneity. Therefore, our results on Hypothesis 5 are mixed.

Table 3.5 Factors Affecting Firm Actions

Dependent variables:	Action Volume	Action Complexity	Action Heterogeneity
Constant	9.50*** (3.04)	0.68** (0.30)	3.46** (1.63)
E-commerce Capabilities	0.94 (0.61)	-0.11 (0.07)	0.92*** (0.33)
Cross-Channel Fulfillment Capabilities	-0.29 (0.39)	-0.11** (0.04)	-0.18 (0.21)
Multichannel Cross-Selling Capabilities	0.05 (0.27)	0.09*** (0.03)	-0.08 (0.14)
IT Assets	0.38*** (0.09)	0.02* (0.01)	0.22*** (0.05)
Financial Resources	-0.11 (0.29)	-0.01 (0.03)	-0.09 (0.15)
Firm Size	-1.07*** (0.32)	-0.05 (0.04)	-0.47*** (0.17)
R2	0.59	0.61	0.64

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Standard errors are reported in parentheses. N=109 for Models 1-3.

Discussions

Antecedents of Cross-Channel Capabilities

Retailers are constantly changing and innovating the ways they serve customers. Some concentrate on one distribution channel and try to do best in their traditional practices, while others attempt to broaden their services to interact with their customers.

As discussed earlier, cross-channel capabilities range from the basic service to provide websites and online transactions, to sophisticated cross-channel inventory management and fulfillment, merchandise and assortment planning, and price and promotion coordination. The goal of channel integration is to create a seamless shopping experience to customers, providing what customers want in the channel of customer's choice. This requires tight integration among different business units and business processes. Our study finds that IT assets as a whole, including networking, web infrastructure, enterprise systems, have a significant effect on cross-channel capabilities. They are the enabling technologies that make channel integration possible.

Our results suggest that different components of IT assets have differentiated impacts on the various dimensions of cross-channel capabilities. The back-end systems, including enterprise systems, supply chain management and logistics systems significantly affect cross-channel fulfillment capabilities. Many apparel retailers now allow online purchase and pick-up at a store of customer's choice. Customers can also return the merchandise purchase online to a store location regardless of whether the merchandise is carried at that store location. To achieve this kind of ability, retailers should have the system that can view and locate inventories at multiple channels and coordinate subsequent logistics operations. Enterprise systems, with functions of cross-channel order management, inventory location, and fulfillment, are essential to achieve this result.

Moreover, our results suggest that CRM and business analytics tools are important to both multichannel fulfillment and cross-selling. These tools play significant roles in business processes that are related to managing and responding to customer

demand. For example, these systems can analyze historical sales, identify the most profitable customers, optimize promotions, track, and prioritize customer orders.

Our study also finds that while apparel retailers have made progress in developing their cross-channel capabilities, their abilities in cross-channel fulfillment are relatively low and uneven. For example, as of 2007, while about 76% of the apparel retailers allow in-store return of online purchased merchandise, only 9% of the stores allow online order and in-store pickup, and 15% of the retailers allow in-store order of stock-out items. In comparison, about 60% percent of the retailers coordinate prices in both channels and 75% of the stores conduct cross-channel promotions. Although it is important for companies to maintain customer intimacy, back-end order fulfillment and seamless operations across different channels are the foundations to guarantee a high-quality customer service. Our results suggest that a balanced IT-asset portfolio and complementary financial resources that support related organizational and human processes are important to develop cross-channel capabilities.

IT Assets and Market Actions

This study suggests that IT assets consistently enhance the frequency and range of competitive actions. In a hypercompetitive environment, the erosion of profit for each market action comes very soon in time. Undertaking more actions could fend off the erosion and deter rivals' intention to react. Carrying out more frequent market activities and a broader set of actions will be perceived as more capable and less predictable (D'Aveni 1994), and may require a more complex resource base that confers multiple advantages (Ferrier et al. 1999). Smith et al. (2001) theorized the relationship between resources, industry structure, and firm actions, and suggested that researchers can

examine how certain configuration of resources affect action and delay reaction and how different resources might be valuable. Strassmann (2005) proposed the use of IT-induced competitive actions as a new kind of IT value measure. This research contributes to the literature of IT business value by examining how IT enhances competitive actions in the apparel industry.

Our study clearly finds that firms with superior IT resources are associated with the frequency of market actions. IT enables companies such as Gap, Cache, Limited, and Abercrombie & Fitch, to launch more market actions ranging from market expansion and product introduction, to marketing campaigns and promotions. IT systems make firms more alert to market changes and customer demand shifts. They also allow companies to launch market actions more efficiently and quicker. On the other hand, IT investment usually incurs a large cost and is quite risky. Companies that leverage their IT assets to conduct more market actions are efficiently using and combining organizational resources. Thus, retailers that have invested in IT systems should consciously develop market-action strategies. The goal is to take full advantage of their IT investment dollars and leverage their IT systems to achieve competitive advantages.

Channel Capabilities and Market Actions

We have examined how specific dimensions of cross-channel capabilities are related to different types of competitive actions. Our results indicate that e-commerce capabilities are strongly associated with action heterogeneity, suggesting that firms with high level of e-commerce capabilities deployed market actions in various ways that are different from the industry norms. Gap is a typical case. The company has taken actions that many others have not. For example, it is expanding and making alliances not only

domestically but also globally to countries such as Saudi Arabia, Turkey, Kuwait, and Germany. It also introduces new product lines such as Piperlime and RED collection. These actions are strongly enabled by the company's superior e-commerce capabilities.

We also find that firm's cross-selling capabilities are significantly linked with action complexity, suggesting that they tend to broaden the range of market actions. For example, Ann Taylor, a specialty retailer, has invested a range of customer service systems and leverages the capabilities to introduce new Collection series and beauty-care products. The company also partners with The Breast Cancer Research Foundation. During the Breast Cancer Awareness Month, Ann Taylor sells its ANN Cares cards both online and in-stores and entitles cardholders discounts at different channels. The company also donates part of the proceeds from the sales to The Breast Cancer Research Foundation. The campaign enhances the store's brand image to its core customer group.

We find no significant impacts of the three cross-channel capabilities on the frequency of firm activities. Also, cross-channel fulfillment capabilities are negatively related with complexity of action repertoire. One explanation is that firms may fall into "rigidity traps" as the organizational core capabilities may become 'core rigidities' (Leonard-Barton 1992). Firms with high fulfillment capability may tend to tailor their competitive actions in a manner that exploits this capability yet overlook other actions.

An alternative explanation is that operation capabilities such as cross-channel fulfillment may accentuate incremental, exploitative innovation in the company, which could inhibit experimentation and impede the range of actions companies take in response to environmental shifts (Benner and Tushman 2002). On the other hand, market-oriented capabilities such as multi-channel cross-selling are more exploratory in nature

and may involve a wide range of activities and actions, which in turn could lead to more complexity of firm actions.

Conclusion

The essay makes several contributions to the literature. First, we collect a longitudinal dataset to investigate how IT affects cross-channel capabilities in the apparel industry. Cross-channel integration is clearly the new development in the retail industry today and many firms in the industry are looking for empirical guidance on how to develop channel integration strategies to provide excellent customer service and increase sales growth. Our research is one of the first attempts to empirically study the relationship between IT assets, channel capabilities, and firm competitive actions. Our results provide interesting implications to managers in the apparel and other retail firms that are looking to leverage the Internet channel to provide better service and create higher customer values.

Second, the research contributes to the literature by examining how IT resources create business values. Prior literature in IT business value often use aggregate measures of firm performance as dependent variable. We examine the impact of IT assets via intermediate business process and help to open the box of how IT help create firms' capabilities and affect firms' managerial actions, which may eventually lead to superior performance. Specifically, we find that IT assets and firm financial resources are highly complementary in affecting cross-channel capabilities. Also, a balanced IT-asset portfolio is important in the IT and channel capabilities relationship. The findings of our study provide guidance to firms when they develop their firm strategies and make decisions on how to invest, reconfigure, and combine their resources.

Third, this study links the literature in RBV, IT business value, and retail service with competitive dynamic theory. A major focus of competitive dynamic research has been on the process of competition examined through competitive reaction and imitation (Smith et al. 2001), but relatively less work has been done on the accumulation of resources and capabilities (Grimm and Smith 1997, Smith et al. 2001). In investigating the impacts of a firm's IT resources and IT-related capabilities on competitive activities, we find that IT assets are important resources that not only increase the frequency of actions, but also broaden the types of actions. Channel integration capabilities have mixed impacts on the characteristics of firm actions. While market-oriented capabilities such as e-commerce and multi-channel cross-selling capabilities broaden the range of market actions, operation-oriented capabilities such as cross-channel fulfillment could narrow a firm's market action range.

As with any research, this essay comes with a number of limitations which open opportunities for further exploration in future research. First, our study only focuses on public firms, which may limit the generalizability of our results to private firms. Given that the economy consists of many closely held private firms and oversea rivals, future research could explore the relationship among IT assets, channel integration, and competitive activities in a larger sample. Second, other factors could be included into our model to extend understanding of the complementary impact of other organizational resources. For example, top management team heterogeneity is an important factor in affecting organizational capabilities. Other possible interesting factors include IT training and organization structures. Finally, we study the impacts of IT assets and channel

integration capabilities at the level of intermediate business processes. Future studies could examine the impacts on the overall firm performance.

APPENDIX A

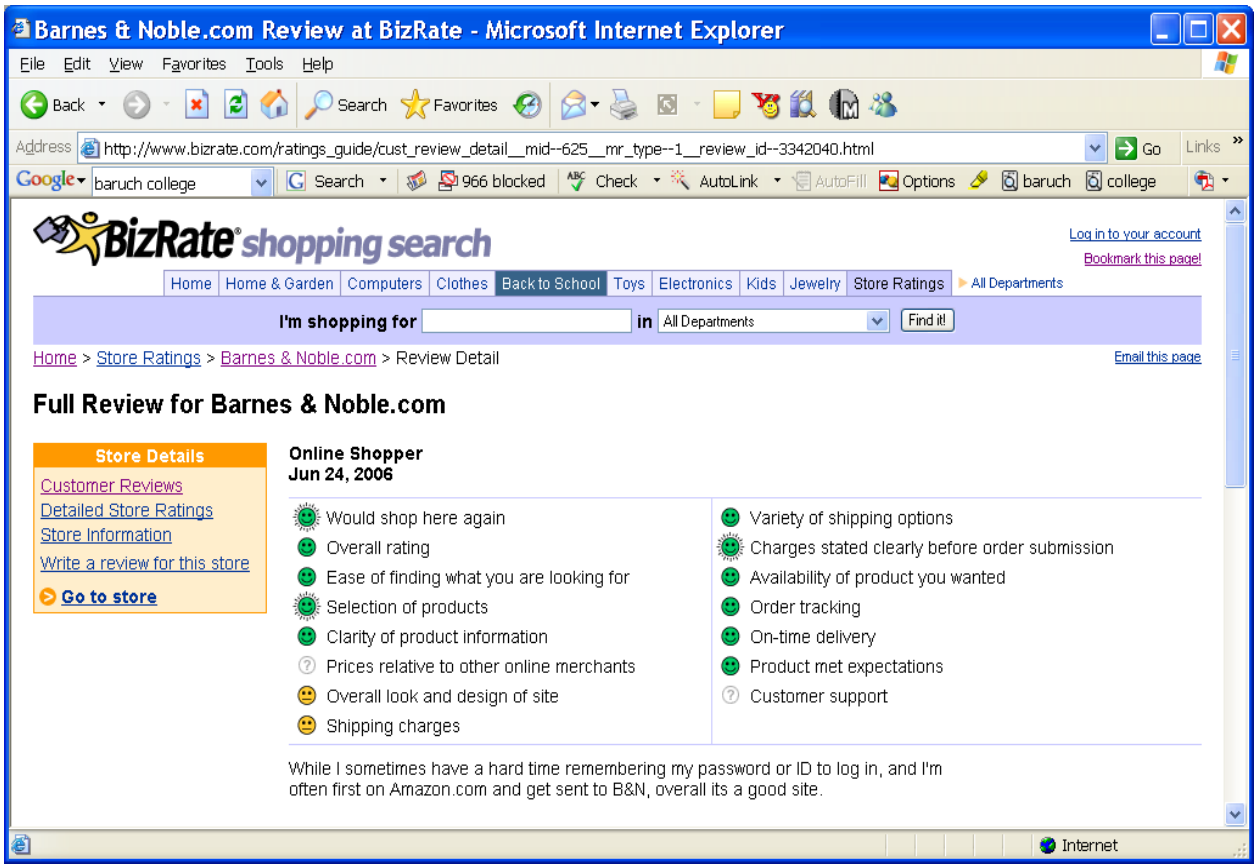
TABLE A.1 FIXED EFFECTS ESTIMATES OF CUSTOMER SATISFACTION

	Model 1	Model 2	Model 3	Model 4
Constant	-0.004 (0.007)	-0.005 (0.007)	0.002 (0.007)	-0.007 (0.013)
Website design	0.039*** (0.009)	-0.020 (0.029)	-0.014 (0.029)	-0.005 (0.025)
Customer service	0.820*** (0.008)	0.852*** (0.027)	0.827*** (0.027)	0.844 (0.026)
Pricing	0.027*** (0.009)	0.037 (0.036)	0.041 (0.036)	0.025*** (0.009)
Uncertainty-Reduction Effects				
Website design * E	--	0.066** (0.030)	0.064** (0.030)	0.054*** (0.026)
Customer service * E	--	-0.036 (0.028)	-0.019 (0.028)	-0.033 (0.027)
Pricing * E	--	-0.012 (0.037)	-0.014 (0.037)	--
Website design * R	--	--	-0.018* (0.009)	-0.011 (0.009)
Customer service * R	--	--	0.065*** (0.011)	0.057*** (0.011)
Pricing * R	--	--	-0.027*** (0.010)	-0.029*** (0.010)
X^2 statistics for product uncertainty interactions	--	2.00**	1.73	4.65*†
X^2 statistics for retailer uncertainty interactions	--	--	11.87***	31.13***

Note: *, **, *** = significant at 10%, 5% and 1% level. Standard errors are reported in parentheses. † The χ^2 statistic is computed for the two remaining product uncertainty Interaction terms.

APPENDIX B

AN EXAMPLE OF AN INDIVIDUAL CONSUMER'S RATINGS OF BARNES & NOBLE.COM ON BIZRATE.COM



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